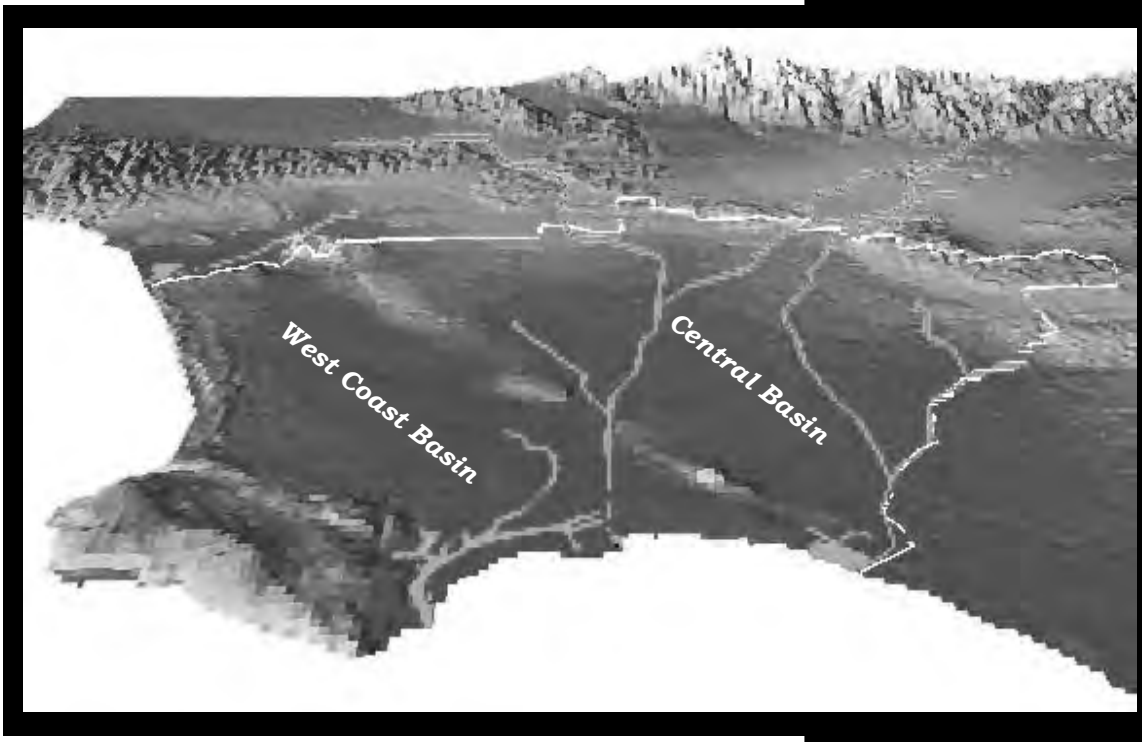

Engineering Survey and Report

2011

WRD

March 4, 2011

Water Replenishment District
Of Southern California

ENGINEERING SURVEY AND REPORT, 2011

BOARD OF DIRECTORS	MANAGEMENT
Division 1	**General Manager**
Willard H. Murray, Jr., Vice President	Robb Whitaker
Division 2	**Chief Engineer**
Robert Katherman, Secretary	Vacant
Division 3	**Chief Hydrogeologist**
Lillian Kawasaki, Director	Theodore Johnson
Division 4	**Chief Financial Officer**
Sergio Calderon, President	Scott Ota
Division 5	**Manager of External Affairs**
Albert Robles, Treasurer	Elsa Lopez
District Counsel	**Manager of Finance and Administration**
Francisco Leal	Jenna Shaunessy

Professional Certification

This Engineering Survey and Report has been prepared under the direct supervision of the California Professional Geologist whose signature appears below. This individual certifies that the information contained in the report has been prepared in accordance with the generally accepted principles and practices of his profession.

(signature to be provided on revised ESR
following Board adoption of Replenishment
Assessment in May)

_____

Theodore A. Johnson, PG 6142, CHG 240

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GLOSSARY OF ACRONYMS

ABP	Alamitos Barrier Project
AF	Acre-Feet (equivalent to 325,851 gallons)
AFY	Acre-Feet per Year
APA	Allowed Pumping Allocation
CB	Central Basin
CBMWD	Central Basin Municipal Water District
CDPH	California Department of Public Health (formerly California Department of Health Services)
CEC	Chemicals of Emerging Concern
CEQA	California Environmental Quality Act
CHG	Certified Hydrogeologist
CIP	Capital Improvement Program
CPI	Consumer Price Index
CWCB	Central and West Coast Basins
DGBP	Dominguez Gap Barrier Project
DPH	California Department of Public Health
DTSC	California Department of Toxic Substances Control
DWR	State Department of Water Resources
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
ESR	Engineering Survey and Report
FY	Fiscal Year (July 1 – June 30)
GAC	Granular Activated Carbon
GIS	Geographic Information System
IRWMP	Integrated Regional Water Management Plan
LACDHS	Los Angeles County Department of Health Services
LACDPW	Los Angeles County Department of Public Works (Flood Control)
LADWP	Los Angeles Department of Water and Power
LBWD	Long Beach Water Department
MAR	Managed Aquifer Recharge
Met	Metropolitan Water District of Southern California
MCL	Maximum Contaminant Level
MF	Microfiltration
MFI	Modified Fouling Index
mgd	Million Gallons per Day
MOU	Memorandum of Understanding

GLOSSARY OF ACRONYMS (continued)

msl	Mean Sea Level
MWD	Metropolitan Water District of Southern California
NDMA	N-Nitrosodimethylamine
O&M	Operations and Maintenance
PG	Professional Geologist
ppb	Parts Per Billion (µg/L)
ppm	Parts Per Million (mg/L)
PRC	Program Review Committee
PWRP	Pomona Water Reclamation Plant
RA	Replenishment Assessment
RO	Reverse Osmosis
RTS	Readiness-to-Serve
RWQCB	Regional Water Quality Control Board (Los Angeles Region)
SAT	Soil Aquifer Treatment
SDLAC	Sanitation Districts of Los Angeles County
SDWP	Safe Drinking Water Program
SGVMWD	San Gabriel Valley Municipal Water District
SJCWRP	San Jose Creek Water Reclamation Plant
TAC	Technical Advisory Committee
TITP	Terminal Island Treatment Plant
USGS	United States Geological Survey
USGVMWD	Upper San Gabriel Valley Municipal Water District
UV	Ultraviolet Light Treatment
VOC	Volatile Organic Compound
WAS	Water Augmentation Study
WBMWD	West Basin Municipal Water District
WCB	West Coast Basin
WCBBP	West Coast Basin Barrier Project
WIN	Water Independence Network
WNWRP	Whittier Narrows Water Reclamation Plant
WRD	Water Replenishment District of Southern California
WRP	Water Reclamation Plant
WY	Water Year (October 1 – September 30)

BOARD SUMMARY

District Staff is pleased to present the 2011 Engineering Survey and Report ("ESR"). It was prepared pursuant to the California Water Code, Section 60300 et seq. and determines the past, current, and ensuing year groundwater conditions in the Central and West Coast Basins ("CWCB"). The report contains information on groundwater production, annual and accumulated overdraft, water levels, quantity, source, and cost of replenishment water, and a discussion of necessary projects and programs to protect and preserve the groundwater resources of the basins.

The ESR provides the Board of Directors with the necessary information to justify the setting of a replenishment assessment ("RA") for the ensuing fiscal year (July 1 – June 30) to purchase replenishment water and to fund projects and programs related to groundwater replenishment and groundwater quality over the water year (October 1 – September 30).

The following is a summary of information presented in the ESR:

1. Groundwater Production

- Adjudicated Amount: 281,835 AF
- Previous Water Year: 241,329 AF
- Current Water Year: 241,000 AF (est)
- Ensuing Water Year: 243,000 AF (est)

2. Annual Overdraft

- Previous Water Year: 84,200 AF
- Current Water Year: 80,800 AF (est)
- Ensuing Water Year: 97,800 AF (est)

3. Accumulated Overdraft

- Previous Water Year: 726,300 AF
- Current Water Year: 703,600 AF (est)

4. Groundwater Levels

Groundwater levels are an indication of the amount of water in the basins. They indicate areas of recharge and discharge and reveal which way the groundwater is moving. Groundwater levels are used to determine when additional replenishment water is required and are used to calculate storage changes. The groundwater levels can also indicate possible source areas for saltwater intrusion and can show the effectiveness of the seawater barrier injection wells along the coast.

WRD staff tracks groundwater levels throughout the year by measuring the depth to water in production wells and monitoring wells. **Plate 3** shows changes in groundwater levels in the CWCB over the previous water year 2009/2010. Because of the storm water captured and purchase of untreated Tier 1 replenishment water by WRD, the Montebello Forebay area experienced a rise of up to 10 feet in some areas and the average increase was about 5 feet. This increase partially but not completely offset the losses incurred in storage over the past 10 years where mostly dry conditions prevailed. Parts of the Lakewood and Long Beach areas saw declines of up to 5 feet. The remainder of the CB was generally unchanged with the exception of a small area near Cerritos which saw an increase of nearly 15 feet. The West Coast Basin was less impacted because the inflows generally matched the outflows in the western and southern parts of the basin, with increases of 5 feet or less observed. But in the northeastern area around Gardena, a decline of nearly 10 feet was observed.

Based on the groundwater levels observed over various areas of the Central and West Coast Basins and the anticipated replenishment activities by WRD, the District anticipates having sufficient supplies of safe and reliable groundwater to meet the demands of the pumpers in the ensuing year.

5. Quantity Required for Replenishment

Chapter IV details the quantity of water that WRD must purchase in the ensuing water year to help offset the annual overdraft. A summary is listed below:

- Spreading Water: 71,000 AF (50,000 recycled; 21,000 imported)
- Seawater Barrier Water: 31,600 AF (14,800 AF recycled; 16,800 imported)
- In-Lieu Program Water: 10,303 AF
- Total Water: 112,903 AF

6. Source of Replenishment Water

The sources of replenishment water to the District for the ensuing water year are detailed in Chapter IV. Seasonal spreading water from MWD has not been available since May 2007 and is not anticipated to be available in the ensuing year. Therefore, like last year WRD is planning for untreated Tier 1 imported water for spreading. The In-Lieu water is not currently available from MWD but is being budgeted for in case it becomes available. If it does not, the collected monies will be placed in a water purchase reserve for replenishment water purchases at a later time. A summary of the sources of replenishment water is as follows:

- Recycled Water: Spreading water from the Sanitation Districts of Los Angeles County (SDLAC). West Coast Basin Barrier Project (WCBBP) water from the West Basin Municipal Water District's Edward C. Little Water Treatment Facility. Dominguez Gap Barrier Project (DGBP) water from the City of Los Angeles Terminal Island Treatment Plant. Alamitos Barrier Project (ABP) water from WRD's Leo J. Vander Lans Facility.

- Imported Water: Spreading water from Central Basin Municipal Water District or other MWD member agencies. WCBBP water and DGBP water from West Basin Municipal Water District. ABP water from the City of Long Beach.

7. Cost of Replenishment Water

WRD has estimated it will need 112,903 AF of replenishment water in the ensuing year. The MWD and their member agencies and the SDLAC set the price for the replenishment water WRD buys for the replenishment at the spreading grounds, barrier wells, and In-Lieu, and are a direct pass-through on WRD's replenishment assessment.

MWD in 2010 established a two-year budget with an anticipated price increase of around 7% for their water. MWD-member agencies such as CBMWD, WBMWD, and Long Beach have not yet set their rates so WRD does not know what their surcharges on the MWD water will be at this time. Over the next couple months, this information will become available and WRD will adjust its water cost estimates prior to adopting its replenishment assessment in May 2011.

Using currently available information and estimates for the cost of replenishment water to WRD in the ensuing year, the 112,903 AF required for purchase will cost approximately $42,156,493. This includes $16,100,428 for the spreading grounds, $22,356,257 for the seawater barrier injection wells, and $3,699,808 for In-Lieu water. **Tables 1 and 2** provide a detailed breakdown of these costs.

These estimated costs are for anticipated water purchases only in the ensuing year for normal WRD operations. They do not include possible makeup water purchases to help overcome the Optimum Quantity deficit as discussed on page 2 of Chapter IV. Nor do they include the additional costs for projects and programs required to replenish the basins and to protect groundwater quality. These projects and programs are discussed in the Chapter V. The anticipated costs for any makeup water and for the projects and programs to protect and preserve groundwater supplies in the District will be presented during the District's annual budgeting and rate setting process that will culminate in the Board's adoption of the 2011/2012 Replenishment Assessment in May 2011 effective July 1, 2011.

8. Projects and Programs

A list of the WRD projects and programs related to groundwater replenishment and the protection and preservation of water quality is shown on **Table 3**. Funds are required to finance these projects and programs. Sections 60221 and 60230 of the Water Replenishment District Act authorize the WRD to undertake a wide range of capital projects and other programs aimed at enhancing groundwater replenishment. Section 60224 of the Water Replenishment District Act states that WRD may establish projects or programs that will directly or indirectly preserve and protect the groundwater supplies within its boundaries.

These projects and programs address any existing or potential problems related to the basin's groundwater, and may extend beyond the District's boundaries if the threat of contamination is outside those boundaries. The programs span all phases of planning, design, and construction and are financed by the collection of a replenishment assessment. A more detailed description of each project and program is presented in Chapter V of the report.

9. Conclusions

Based upon the information presented in the ESR, a replenishment assessment is necessary in the ensuing year to purchase replenishment water for managed aquifer recharge to help make up the annual overdraft and to finance projects and programs to perform replenishment and water quality activities. These actions will ensure sufficient supplies of high quality groundwater within the District for the benefit of the residents and businesses in the Central and West Coast Basins.

CHAPTER I
INTRODUCTION

Purpose of the Engineering Survey & Report

To facilitate the Board of Directors' decisions and actions, the Water Replenishment District Act requires that an engineering survey and report ("ESR") be prepared each year. This *Engineering Survey and Report 2011* is in conformity with the requirements of Section 60300 et seq. Water Replenishment District Act and presents the necessary information on which the Board of Directors can declare whether funds shall be raised to purchase water for replenishment during the ensuing year, as well as to finance projects and programs aimed at accomplishing groundwater replenishment. With the information in this ESR, the Board can also declare whether funds shall be collected to remove contaminants from the groundwater supplies or to exercise any other power under Section 60224 of the California Water Code. The information presented in this report along with the District's strategic planning and budget preparation presents the necessary information on which the Board of Directors can base the establishment of a replenishment assessment for the ensuing year 2011/2012.

Scope of Engineering Survey & Report

This report contains specific information outlined in Chapter I, Part 6 of Division 18 of the Water Code (the Water Replenishment District Act, § 60300 and § 60301). The following is a brief description of the contents of this report:

1) *a discussion of groundwater production within the District (Chapter II);*
2) *an evaluation of groundwater conditions within the District, including estimates of the annual overdraft, the accumulated overdraft, changes in water levels, and the effects of water level fluctuations on the groundwater resources (Chapter III);*
3) *an appraisal of the quantity, availability, and cost of replenishment water required for the ensuing water year (Chapter IV); and*
4) *a description of current and proposed programs and projects to accomplish replenishment goals and to protect and preserve high quality groundwater supplies within the District (Chapter V).*

Schedule for Setting the Replenishment Assessment

The following actions are required by the Water Code to set the Replenishment Assessment:

1) *The Board shall order the preparation of the ESR by the second Tuesday in February (see Section 60300).*
2) *The Board shall declare by resolution whether funds shall be collected to purchase replenishment water and to fund projects and programs related to replenishment and/or water quality activities by the second Tuesday in March and after the ESR has been completed (see Section 60305).*
3) *A Public Hearing will be held for the purpose of determining whether District costs will be paid for by a replenishment assessment. The Public Hearing will be opened on or before the second Tuesday in April and may be continued from time to time to subsequent Board meetings but will be completed by the first Tuesday in May (see Section 60306).*

4) The Board by resolution shall levy a replenishment assessment for the ensuing fiscal year by the second Tuesday in May (see Sections 60315; 60317).

Although dates specified in the code refer generally to 'on or before certain Tuesdays', the Water Code (Section 60043) also states that "*Whenever any act is required to be done or proceeding taken on or set for a particular day or day of the week in any month, the act may be done or proceeding set for and acted upon a day of the month otherwise specified for a regular meeting of the board"*. Therefore, there is flexibility as to the actual dates when Board actions are taken regarding the ESR, adopting resolutions, conducting public hearings, and the setting the replenishment assessment.

The ESR is completed in March of each year to provide the Board with the necessary information to determine whether a replenishment assessment will be needed in the ensuing year to purchase replenishment water and to fund projects and programs related to water quality and replenishment activities. However, in the subsequent months leading up to the adoption of the replenishment assessment in April or May, new information is normally received that affects the findings presented in the March ESR. This new information is typically related to the price WRD has to pay for replenishment water since the rates set by the Metropolitan Water District of Southern California (MWD or Met) and the Met-member agencies are not typically finalized until after the March ESR is adopted. The final information used by the Board to adopt the replenishment assessment in April or May is reflected in an updated ESR published following the adoption of the replenishment assessment.

CHAPTER II
GROUNDWATER PRODUCTION

Adjudication and Demand

Prior to the adjudication of groundwater rights in the early 1960s, annual production (pumping) reached levels as high as 292,000 AF in the Central Basin ("CB") and 94,000 AF in the West Coast Basin ("WCB"). This was more than double the natural safe yield of the basins as determined by the California Department of Water Resources in 1962 (173,400 AF). Due to this serious overdraft, water levels declined, groundwater was lost from storage, and seawater intruded into the coastal aquifers. To remedy this problem, the courts adjudicated the two basins to put a limit on pumping. The West Coast Basin adjudication was set at 64,468.25 acre-feet per year ("AFY"). The Central Basin adjudication was set at 271,650 AFY, although the Judgment set a lower "Allowed Pumping Allocation" ("APA") of 217,367 AFY to impose stricter control. Therefore, the current amount allowed to be pumped from both basins is 281,835 AFY.

The adjudicated pumping amounts are greater than the natural replenishment of the groundwater aquifers, creating an annual deficit or annual overdraft. WRD is enabled under the California Water Code to purchase and recharge additional water to make up the overdraft, which is known as artificial replenishment or managed aquifer recharge (MAR). WRD has the authority to levy a replenishment assessment on all pumping within the District to raise the monies necessary to purchase the artificial replenishment water and to fund projects and programs necessary for replenishment and groundwater quality activities.

Production

Under the terms of Section 60326.1 of the Water Replenishment District Act, each groundwater producer must submit a report to the District summarizing their monthly production activities (quarterly for smaller producers). The information from these reports is the basis by which each producer pays the replenishment assessment. WRD then provides these production data to the State Department of Water Resources ("DWR"), which acts as the court-appointed Watermaster in connection with the adjudication of the Central and West Coast Basins ("CWCB").

Previous Water Year:

Per the Water Code, WRD tracks and reports on groundwater production (pumping) on a Water Year ("WY") basis covering the time frame of October 1 - September 30 for each year. For the previous WY (2009/2010), groundwater production in both basins totaled 241,329 AF (197,387 AF in CB and 43,942 AF in the WCB). This is 2,073 AF less than the previous water year (769 AF less in the CB and 1,304 AF less in the WCB).

Plate 1 illustrates the groundwater production in the CWCB during the previous water year and **Table A-5** presents historical pumping amounts in the CWCB.

Current Water Year:

For the first two months of the current WY (October and November 2010), production was 36,991 AF in the two groundwater basins (30,019 AF in the CB and 6,972 AF in the WCB). This is 258 AF more than in October and November of the previous year. However, due to the WRD Board's

declaration of a Water Emergency on November 19, 2010 (see below), it is anticipated that pumping may end up lower than in the previous year. Taking this into account, it is currently estimated that the pumping in the current WY will total 241,000 AF (197,000 AF in CB and 44,000 AF in the WCB).

Ensuing Water Year:

To estimate production for the ensuing year, recent averages are used in addition to knowledge of changing conditions that might affect pumping. Actual pumping patterns can vary considerably throughout the year based on a pumper's individual operational needs, water demands, conservation efforts and hydrology, making accurate forecasting difficult.

To estimate the ensuing year's groundwater production, WRD is using the average of the past 3 years actual pumping (rounded to nearest 500 AF). This equals 243,000 AF total for both basins including 200,500 AF in the CB and 42,500 AF in the WCB. **Table 1** shows the groundwater production amounts for the previous, current, and ensuing water years.

Measurement of Production

With few exceptions, meters installed and maintained by the individual producers measure the groundwater production from their wells. Through periodic testing, DWR as Watermaster verifies the accuracy of individual meters and orders corrective measures when necessary. The production of the few wells that are not metered is estimated on the basis of electrical energy consumed by individual pump motors, duty of water, or other reasonable means.

Carryover and Drought Provisions

The "carryover" of unused rights influences the actual amount of production for any given year. The "carryover" for any single year is 20% of the allotted pumping right in both the Central and West Coast Basins. This provision of the Judgments extends the flexibility with which the pumpers can operate. Conversely, the use of rights beyond the annual allotted quantity affects the annual production amount in the opposite manner.

During emergency or drought conditions, WRD can allow under certain conditions an additional 27,000 AF of extractions for a four-month period (17,000 for CB and 10,000 for WCB) assuming certain conditions are met. This provision has yet to be exercised but offers the potential use of an additional 7.8% pumping in the CB and 15% in the WCB.

Drought Carryover due to a WRD-Declared Water Emergency

The Central Basin Judgment also contains an additional Drought Carryover provision available to all Central Basin water rights holders after a declaration of a Water Emergency by the WRD Board of Directors. The Drought Carryover allows water rights holders to carryover an additional 35% of their APA (or 35 AF, whichever is larger) beyond the annual 20% described above during the period that the Declared Water Emergency is in effect.

The intent of the action is prevent further degradation of the groundwater basins by helping to restore groundwater levels and improving the water supply in the aquifers by providing an incentive to groundwater producers in the Central Basin to reduce pumping for a particular period of time.

A Declared Water Emergency is defined in the Judgment as:

> *"A period commencing with the adoption of a resolution of the Board of Directors of the Central and West Basin Water Replenishment District declaring that conditions within the Central Basin relating to natural and imported supplies of water are such that, without implementation of the water emergency provisions of this Judgment, the water resources of the Central Basin risk degradation. In making such declaration, the Board of Directors shall consider any information and requests provided by water producers, purveyors and other affected entities and may, for that purpose, hold a public hearing in advance of such declaration. A Declared Water Emergency shall extend for one (1) year following such resolution, unless sooner ended by similar resolution."*

In 2010 the District received formal requests to declare a Water Emergency from 21 Central Basin pumpers, representing 55.2% of the water rights holders in the Central Basin. Additionally, the Central Basin Water Association and the District's Technical Advisory Committee both recommended such a declaration. Staff reviewed the requests and analyzed the current groundwater conditions in the Central Basin as follows:

- Water years 2007-2009 were the 12th driest three-year period in the State's measured hydrologic record and also marked a period of severe restrictions in State Water Project diversions from the Sacramento-San Joaquin River Delta to protect endangered fish species. As a result, the Central Basin has seen a significant drop in water levels and storage due to reduced availability of both imported and local (stormwater) groundwater replenishment supplies.

- The Montebello Forebay key well 1601T was near 32-year lows.

- The average elevation of the four Central Basin key wells identified in the Central Basin Judgment to assess the health of the basin was near 32 year lows.

- Groundwater levels in the southern portion of the Central Basin were near historic lows.

- The accumulated overdraft of the Central and West Coast Basins is approximately 140,000 acre-feet below the WRD Board adopted optimum quantity.

- Future availability of discounted imported replenishment water from MWD, the water the District has relied upon for nearly 50 years to replenish the basins, was cut off by MWD in May 2007 and remains unavailable to this day with future availabilities uncertain.

- The next grade of water for replenishment is the more expensive untreated Tier 1 water. WRD does not have an agreement for this water and must rely on surplus Tier 1 that may be available from MWD member agencies within the District's service area.

Based on this information and the requests received from the Central Basin water rights holders, on November 19, 2010 the WRD Board held a Public Hearing to accept testimony and receive evidence on the Declared Water Emergency, and adopted Resolution 10-892 to declare the water emergency effective November 19, 2010 for a period of one year unless ended sooner by another WRD Resolution.

CHAPTER III
GROUNDWATER CONDITIONS

Introduction

The California Water Code Section 60300 requires WRD to determine annually in the Engineering Survey and Report ("ESR") the following items related to groundwater conditions in the Central and West Coast Basins ("CWCB"):

1) Total groundwater production for the previous water year and estimates for the current and ensuing water years;

2) The Annual Overdraft for the previous water year and estimates for the current and ensuing water years;

3) The Accumulated Overdraft for previous water year and an estimate for the current water year;

4) Changes in groundwater levels (pressure levels or piezometric heights) within the District and the effects these changes have on groundwater supplies within the District; and

5) An estimate of the quantity, source, and cost of water available for replenishment during the ensuing water year;

To meet these requirements, WRD's hydrogeologists and engineers closely monitor and collect data to manage the groundwater resources of the District throughout the year. They track groundwater levels from WRD's network of specialized monitoring wells and from groundwater producers' production wells. They update and run computer models developed by the United States Geological Survey ("USGS") and others to simulate groundwater conditions and to predict future conditions. They use their geographic information system ("GIS") and database management system to store, analyze, map, and report on the information required for the ESR. They work closely with the Los Angeles County Department of Public Works on spreading grounds and seawater barrier wells to determine current and future operational impacts to groundwater supplies. They work closely with the Metropolitan Water District of Southern California ("MWD" or "Met"), the local MWD member agencies, and the Sanitation Districts of Los Angeles County ("SDLAC") on the current and future availability of supplemental replenishment water. They also work with regulators on replenishment criteria for water quality and recycled water use, and with the groundwater pumpers, the pumpers' Technical Advisory Committee ("TAC"), and other stakeholders to discuss the current and future groundwater conditions within the District and in neighboring basins.

The information on Annual Overdraft, Accumulated Overdraft, water levels, and change in storage are discussed in the remainder of this chapter. Groundwater production was previously discussed in Chapter II. The estimated quantity, source, and cost of replenishment water will be discussed in Chapter IV.

Annual Overdraft

Section 60022 of the Water Replenishment District Act defines Annual Overdraft as "*...the amount...by which the quantity of groundwater removed by any natural or artificial means from the*

groundwater supplies within such replenishment district during the water year exceeds the quantity of non-saline water replaced therein by the replenishment of such groundwater supplies in such water year by any natural or artificial means other than replenishment under the provisions of Part 6 of this act or by any other governmental agency or entity." (Part 6 of the Act pertains to water that WRD purchases for replenishment). Therefore, the Annual Overdraft equals the natural inflows to basins (not including WRD purchased water) minus all of the outflows (mostly pumping). There is an Annual Overdraft almost every year for the simple fact that the groundwater extractions typically exceed the natural groundwater replenishment. It has been one of the District's main responsibilities since 1959 to help make up this Annual Overdraft by purchasing artificial replenishment water to recharge the aquifers and supplement the natural recharge.

To determine the Annual Overdraft for the previous water year, WRD determines the inflows and outflows of the CWCB. In Water Year 2009/2010, natural inflows (storm water capture, areal recharge, and underflow) totaled 157,125 AF and WRD purchased 111,201 AF of recharge water (at barrier wells and spreading grounds). The total net outflows from the basins were 241,326 AF from pumping. The difference between the inflows and outflows was +27,000 AF, which is a gain in storage. The Annual Overdraft is the natural inflows minus total outflows, or 84,201 AF.

For the current and ensuing WY estimates for Annual Overdraft, the concept of "Average Annual Groundwater Deficiency" is utilized. The Average Annual Groundwater Deficiency is the long-term average of natural inflows minus total outflows and represents the long term average deficit (Annual Overdraft) in the basins. The development of the USGS/WRD computer model derived these long term average inflow and outflow terms. **Table 4** presents this information, which concluded that the Average Annual Groundwater Deficiency is 105,385 AFY. Values of the average deficiency are based on the long term (30 year average) inflows and outflows as calculated by the computer model. Long-term average inflows are influenced by the amount of precipitation falling on the District as well as for storm water capture at the spreading grounds. **Table 5** and **Figure A** show the historical precipitation at LACDPW Station #107D, located in Downey near the Montebello Forebay.

The calculation of the Average Annual Groundwater Deficiency represents in general that WRD needs to replenish about 105,385 AFY assuming long-term average conditions for the water balance to reach equilibrium, the overall change in storage to equal zero, and groundwater levels to remain relatively constant. As shown in **Table 6**, adjustments are made to the long term average inflows and outflows for the current and ensuing WY to reflect estimates of the Annual Overdraft for those particular years. Based on these adjustments, the current year Annual Overdraft is estimated at 80,800 AF and for the ensuing year 97,800 AF.

Accumulated Overdraft

Section 60023 of the Water Replenishment District Act defines *"Accumulated Overdraft"* as "*...the aggregate amount…by which the quantity of ground water removed by any natural or artificial means from the groundwater supplies…during all preceding water years shall have exceeded the quantity of nonsaline water replaced therein by the replenishment of such ground water supplies in such water years by any natural or artificial means…"*

In connection with the preparation of Bulletin No. 104-Appendix A (1961), the DWR estimated that the historically utilized storage (Accumulated Overdraft) between the high water year of 1904 and

1957[1] was 1,080,000 AF (780,000 in CB, 300,000 in WCB). Much of this storage removal was from the forebay areas (Montebello Forebay and Los Angeles Forebay), where aquifers are merged, unconfined and serve as the "headwaters" to the confined pressure aquifers. Storage loss from the confined and completely full, deeper aquifers was minimal in comparison or was replaced by seawater intrusion, which can not be accounted for under the language of the Water Code since it is considered saline water.

The goal of groundwater basin management by WRD is to ensure a sufficient supply of safe and reliable groundwater in the basins for annual use by the pumpers, to keep a sufficient supply in storage for times of drought when imported water supplies may be curtailed for several consecutive years as well as to keep suitable room available in the basins to receive natural water replenishment in very wet years, such as an El Niño type year.

To compute the Accumulated Overdraft since this initial amount, WRD takes each consecutive year's Annual Overdraft and replenishment activities and determines the change in storage. It adds to or subtracts the corresponding value from the Accumulated Overdraft. Since the base level, the aggregate excess of extractions over recharge from the basins has been reduced due to the replenishment by WRD, the reduction of pumping from the adjudications, and the replenishment from seawater barrier injection. The Accumulated Overdraft at the end of the previous WY was determined to be 726,300 AF. For the current year, the Accumulated Overdraft is forecast to be 703,600 AF. This could change if hydrology or pumping patterns or planned artificial replenishment activities vary considerably.

Table 7 presents information for the previous and current Accumulated Overdraft estimate. The annual changes in storage since 1961/1962 are presented on **Table 8**.

Groundwater Levels

A groundwater elevation contour map representing water levels within the District in fall 2010 (end of the water year) was prepared for this report and is presented as **Plate 2**. The data for the map were collected from wells that are screened in the deeper basin aquifers where the majority of groundwater pumping occurs. These deeper aquifers include the Upper San Pedro Formation aquifers, including the Lynwood, Silverado, and Sunnyside. Water level data was obtained from WRD's network of monitoring wells and from groundwater production wells that are screened in the deeper aquifers.

As can be seen on **Plate 2**, groundwater elevations range from a high of about 170 feet above mean sea level (msl) in the northeast portion of the basin above the spreading grounds in the Whittier Narrows to a low of about 120 feet below msl in the Long Beach area and about 130 feet below msl in the Gardena area. With the exception of the Montebello Forebay and along the West Coast Basin Barrier Project, the majority of groundwater levels in the District are below sea level, which is why continued injection at the seawater barriers is needed to prevent saltwater intrusion.

Plate 2 also shows the location of the key wells used for long-term water level data. These long-term hydrographs have been presented in the ESR for years, and provide a consistent basis from

[1] DWR Bulletin 104-A did not refer to the ending year for the storage determination. WRD has assumed it to be the year 1957, as this is the end year for their detailed storage analysis presented in Bulletin 104-B – Safe Yield Determination.

which to compare changing water levels. A discussion of water levels observed in the key wells is presented below.

Los Angeles Forebay

The Los Angeles Forebay occupies the westerly portion of the Central Basin Non-Pressure Area. Historically a recharge area for the Los Angeles River, this forebay's recharge capability has been substantially reduced since the river channel was lined. Recharge is now limited to deep percolation of precipitation, in-lieu when available, subsurface inflow from the Montebello Forebay, the northern portion of the Central Basin outside of WRD's boundary, and relatively small amounts from the San Fernando Valley through the Los Angeles Narrows.

Key well **2S/13W-10A01** represents the overall water level conditions of the Los Angeles Forebay (see **Figure B**). The water level high was observed in 1938 and by 1962 water levels had fallen nearly 180 feet due to basin over-pumping and lack of sufficient natural recharge. Since then, basin adjudication and managed aquifer recharge by WRD and others have improved water levels in this area by over 80 feet. Over the past 10 years, groundwater levels in this well have remained relatively constant with only minor fluctuations. This past year saw a rise of less than a foot.

For the current water year, rainfall is about normal for a full year with a couple months to go in the rainy season. Therefore, it is expected that the water year will end up slightly above normal for precipitation amounts. This plus a pumping decrease that is expected (See Section II) and the spreading of untreated Tier 1 (firm delivery) imported water in the Montebello Forebay are expected to cause water levels in the Los Angeles Forebay to slightly rise in the current year.

Montebello Forebay

The Montebello Forebay lies in the northeastern portion of the Central Basin and connects with the San Gabriel Basin to the north to the Central Basin via the Whittier Narrows. The Rio Hondo and San Gabriel River Spreading Grounds in the forebay provide the vast majority of artificial recharge to the Central Basin aquifers. Three key wells help describe the water level conditions in the Montebello Forebay, a northern well, middle well, and southeastern well (**Plate 2**):

- **Well 2S/11W-18C07** (WRD Monitoring Well Pico#1, Zone 4) is in the northern part of the Montebello Forebay. It replaces the earlier production well 2S/11W-18K02 that had been used for over 50 years but has been destroyed. The upper chart on **Figure C** shows the water levels for this well. At the end of water year 2009/2010, groundwater levels in this well were 9 feet higher than the previous year due to natural and managed replenishment efforts.

- **Well 2S/12W-24M08** (LACDPW Well No. 1601T) is centrally located between the two spreading grounds. This well is monitored weekly by WRD to assess water levels in the forebay and as an indicator of the water levels in the middle of the Forebay and as an indicator for purchasing replenishment water. The middle chart on **Figure C** shows the water levels for this well. The historic water level high was observed in 1942, but by 1957 had fallen 117 feet to an all-time low due to basin over-pumping and insufficient natural recharge. As described above for the Los Angeles Forebay, adjudication of pumping rights and managed aquifer recharge helped restore water levels in the Montebello Forebay. Due to drought and lack of discounted replenishment water, this well had recently been experiencing dropping water levels and reached

a 32-year low in 2009. However in WY 2009/2010 it recovered somewhat due to precipitation recharge and purchase of untreated Tier 1 water by WRD for replenishment. At the end of WY 2009/2010, groundwater levels in this well were 8 feet higher than the previous year.

- **Well 3S/12W-01A06** (LACDPW Well No. 1615P) is located downgradient and southeast of the spreading grounds near the southern end of the Montebello Forebay and the water level responses in this well are less pronounced than the other two wells because it is further from the spreading grounds and the recharge that occurs there. The lower chart on **Figure C** shows the water levels for this well. At the end of water year 2009/2010, groundwater levels in this well were 0.5 feet lower than the previous year.

- For the current water year, rainfall is about normal for a full year with a couple months to go in the rainy season. Therefore, it is expected that the water year will end up slightly above normal for precipitation amounts. This plus a pumping decrease that is expected (See Section II) and the spreading of untreated Tier 1 (firm delivery) imported water in the Montebello Forebay are expected to cause water levels to rise in the current year.

Central Basin Pressure Area

The District monitors key wells **4S/13W-12K01** (LACDPW No. 906D) and **4S/12W-28H09** (LACDPW No. 460K) which represent the conditions of the pressurized groundwater levels in the Central Basin Pressure Area. The hydrographs for these two wells are shown on **Figure D**.

Groundwater highs were observed in these wells in 1935 when they began to continually drop over 110 feet until their lows in 1961 due to the over-pumping and insufficient natural recharge. Groundwater levels recovered substantially during the early 1960s as a result of replenishment operations and reduced pumping. Between 1995 and 2007 there have been 100-foot swings in water levels each year from winter to summer. These swings were due to pumping pattern changes by some of the Central Basin producers who operate with more groundwater in the summer months and less groundwater in the winter months, and took advantage of the MWD and WRD In-Lieu program. However, since May 2007 the In-Lieu water has not been available, so pumping has remained more constant throughout the year and water levels remain depressed as shown in the two hydrographs.

At the end of WY 2009/2010, water levels in well 4S/13W-12K01 were nearly a foot lower than the previous year, and well 4S/12W-28H09 was 7.5 feet lower than the previous year. This drop is expected due to an increase in pumping the past year in this area. Water levels in the CB Pressure area are expected to rise in the current year due to anticipated reduced pumping.

West Coast Basin

The West Coast Basin is separated from the Central Basin by the Newport-Inglewood Uplift which is a series of discontinuous, subparallel hills and faults that act as a partial barrier to groundwater flow. Groundwater moves across the uplift from one basin to the other based on water levels on either side of the uplift and the "tightness" of the fault along various reaches.

Figure E shows the hydrographs of key wells **3S/14W-22L01** (LACDPW No. 760C) and **4S/13W-21H05** (LACDWP No. 869). These two wells represent the general conditions of the water levels in the West Coast Basin. In 1955, the control of groundwater extractions in the West Coast Basin

resulted in stabilizing and reversal of the declining water levels in the center of the basin (well 3S/14W-22L01), whereas at the eastern end near the Dominguez Gap Barrier water levels continued to decline until about 1971, when a recovery began due mostly to the startup of the Dominguez Gap Barrier Project. For the previous year 2009/2010, water levels in both wells were about 2 feet higher than the previous year. Water levels in the West Coast Basin are expected to rise another couple feet in the current year due to reduced pumping and increased injection.

Plate 3 shows the water level changes over the entire CWCB over the previous water year. Because of the storm water captured and purchase of untreated Tier 1 replenishment water by WRD, the Montebello Forebay area experienced a rise of over 10 feet in some areas compared to the previous year and the average increase in the Forebay was about 5 feet. This increase partially but not completely offset the losses incurred in storage over the past 10 years where mostly dry conditions prevailed. Parts of the Lakewood and Long Beach areas saw declines of up to 5 feet. The remainder of the CB was generally unchanged with the exception of a small area near Cerritos which saw an increase of nearly 15 feet. The West Coast Basin was less impacted because the inflows generally matched the outflows in the western and southern parts of the basin, with increases of 5 feet or less, but in the northeastern area around Gardena a decline of nearly 10 feet was observed.

Based on the groundwater levels observed over various areas of the Central and West Coast Basins and the anticipated replenishment activities by WRD, the District anticipates having sufficient supplies of safe and reliable groundwater to meet the demands of the pumpers in the ensuing year.

Change in Storage

The District determines the change in storage by comparing water levels from one year to the next. Rising water levels means an increase in storage groundwater whereas a drop in water levels means a decrease in storage. Using groundwater elevation data collected from WRD's monitoring well network and selected production wells, the District constructs a groundwater level change map showing water level differences from one year to the next (**Plate 3**). The data from this map are multiplied by the storage coefficient values for the aquifers as obtained from the USGS calibrated model of the District to produce the change in storage estimate for the previous water year.

As reported in the Annual Overdraft discussion, the gain in storage in WY 2009/2010 was 27,000 AF. In the past 10 years, groundwater in storage has declined by 114,400 acre-feet, including the gain observed in 09-10. **Table 8** provides the historical tracking of storage changes in the CWCB.

Optimum Groundwater Quantity

In response to a 2002 State audit of the District's activities, the Board of Directors adopted an Optimum Quantity for groundwater amounts in the Central and West Coast Basins. The Optimum Quantity is based on the Accumulated Overdraft (AOD) concept described in the Water Code and in this ESR. The historic maximum groundwater drawdown due to over pumping reported in the CWCB between 1904 and 1957 was 1,080,000 AF. This is defined as the historic maximum AOD. As pumping eased and artificial replenishment occurred, more water was put back into the basins and the AOD was reduced resulting in rising water levels.

After considerable analysis and discussion, on June 18, 2003 the Board of Directors adopted the Optimum Quantity for the CWCB at an AOD of 400,000 AF, or 680,000 AF on top of the historic maximum AOD. The adopted value was based on the amount of groundwater necessary to meet the

pumpers' demands in a worst case scenario of a major 3-year major drought where pumping would be maximized due to a lack of MWD water and replenishment at the spreading grounds and other means is at a minimum.

In 2003 through 2006, however, new discussions were being held by the local water community on groundwater storage opportunities within the District. The original derivation of the Optimum Quantity of AOD = 400,000 AF did not take into full account storage projects. If this Optimum Quantity were fully realized, there would not be enough storage space in the aquifers for large storage projects. Therefore, to utilize the groundwater basins for both endeavors, the Board of Directors on April 19, 2006 established a new Optimum Quantity at an AOD of 612,000 AF. This value was based on an extensive review of over 70 years of water level fluctuations in the District and recognizing that in the year 2000, groundwater amounts were at a healthy quantity to sustain the adjudicated pumping rights in the basins. The AOD in the year 2000 was 612,000, and therefore was set by the Board of Directors as the new Optimum Quantity.

The Board of Directors at that April 19, 2006 meeting also adopted a policy to make up the Optimum Quantity should it fall too low. The policy is as follows:

> *An Accumulated Overdraft greater than the Optimum Quantity is a deficit. WRD will make up the deficit within a 20 year period as decided by the Board on an annual basis. If the deficit is within 5 percent of the Optimum Quantity, then no action needs to be taken to allow for natural replenishment to makeup the deficit.*

Since the year 2000 a total of approximately 114,300 AF have been lost from storage, brining the AOD down to 726,300 AF from its Optimum Quantity of 612,000 AF. Based on the adopted policy, the Board will be considering options to make up the AOD and return the basin to the Optimum Quantity over a period of time.

CHAPTER IV
GROUNDWATER REPLENISHMENT: QUANTITIES, AVAILABILITY, AND COSTS

As discussed in the previous chapter, the Central and West Coast Basins have an annual overdraft because more groundwater is pumped out than is replaced naturally. The District purchases supplemental water (artificial replenishment water) each year to help offset this overdraft through managed aquifer recharge. The purchased water enters the groundwater basins at the Montebello Forebay spreading grounds, at the seawater barrier injection wells, and through the District's In-Lieu Program. The purpose of this Chapter is to determine the quantities of water needed for purchase in the ensuing year and to determine the availability and cost of that water.

The District currently has available to it recycled and imported water sources for use as artificial replenishment water. These two sources are described below:

- ***Recycled Water****: Recycled water is wastewater from the sewer systems that is reclaimed through extensive treatment at water reclamation plants ("WRP"s). The water is treated to high quality standards so that it can be reused safely. Some agencies and businesses use recycled water for non-potable purposes, such as for irrigation of parks, golf courses, and street medians, or for industrial purposes. WRD has used recycled water for groundwater recharge since 1962. In semi-arid areas such as Southern California where groundwater and imported water are in short supply, recycled water has proven to be a safe and reliable additional resource to supplement the water supply. Recycled water is used at the spreading grounds and the seawater barrier wells. Although recycled water is high quality, relatively low cost, and a reliable supply all year long, the District is limited by regulatory agencies in the amount it can use for replenishment. Therefore, imported water is also used for recharge.*

- ***Imported Water****: River water from northern California (State Water Project) and the Colorado River is imported into Southern California by the Metropolitan Water District of Southern California ("MWD" or "Met"). MWD then sells this water to their member agencies for multiple uses, including potable water and recharge water. WRD uses raw (untreated) imported water at the spreading grounds and potable (treated) imported water at the seawater intrusion barriers and for the in-lieu program for groundwater recharge. Because of treatment and transportation costs, it is the most expensive source for recharge water. The supply is under full upstream control, and its availability at the spreading grounds is limited and variable, especially during drought years. In fact, since May 2007 MWD has stopped delivery of its historically available discounted surplus replenishment and In-Lieu waters due to reduced supply, environmental issues and judicial decisions. As a result, the District purchased the more expensive but more available untreated Tier 1 water from CBMWD and Long Beach in 2010/2011 for spreading. Because it is questionable that the discounted replenishment water will be available anytime soon, the District plans on purchasing the Tier 1 water in the ensuing year as well.*

Recommended Quantities of Replenishment Water

With information presented in the preceding chapters regarding the basins' pumping demands and the overall condition of the groundwater basins, WRD can estimate its projected need for replenishment water in the ensuing year.

Spreading

Groundwater recharge through surface spreading occurs in the Montebello Forebay Spreading Grounds adjacent to the Rio Hondo and the San Gabriel River, within the unlined portion of the San Gabriel River, and behind the Whittier Narrows Dam in the Whittier Narrows Reservoir. Owned and operated by the Los Angeles County Department of Public Works ("LACDPW"), they were originally constructed in 1938 for flood control and conservation of local storm water, but have been used since the 1950s to replenish the basins with imported water and since 1962 with recycled water.

Since recycled water is a high quality, less expensive, and available year-round source of replenishment water, the District maximizes its use within established regulatory limits. These limits are discussed below under "Expected Availability of Replenishment Water". In general, the District plans on purchasing 50,000 AF in the ensuing year to maximize the amount under regulatory limits, unless lack of dilution water (storm water and imported water) causes a reduction in the recycled water amounts.

Additional replenishment water is needed beyond the 50,000 AFY of recycled water and will have to come from imported water. In 2003, the WRD Board adopted the long term average of 27,600 AFY of imported water to purchase for spreading. This value was based on long-term (30 year) averages of the overall water budget of the basins using the USGS computer model. The 2003 ESR discusses the derivation of this value in more detail.

Since that time, the District has invested in cooperative projects with the LACDPW to capture more storm water and to lessen the need for imported water as part of WRD's Water Independence Now program, or WIN. Improvements to the Whittier Narrows Conservation Pool are expected to conserve an additional 3,000 AFY of storm water on average. Two new rubber dams were built in the San Gabriel River near Valley Boulevard and are expected to conserve an additional 3,600 AFY on average. Therefore, the new Long Term Average for imported spreading demands is 21,000 AFY. This amount plus the recycled demand cited earlier brings the total WRD basic spreading needs for the ensuing year to 71,000 AF (50,000 AF recycled and 21,000 AF imported). This is the amount planned for the ensuing year for spreading.

In addition, supplemental water may be needed to make up the deficit in the Optimum Quantity discussed at the end of Chapter 3. Per the Board's policy in 2006, the District would attempt to make up the Optimum Quantity deficit over a 20-year period. Much of this deficit, however, could be made up by rainfall if a few extremely wet years would occur. Therefore, focus is placed on making up the imported spreading water shortage which exists due to the District's inability to purchase planned amounts in recent years. Factors such as MWD ceasing to offer traditional replenishment water in May 2007 and construction and maintenance projects at the spreading grounds have been impedances to purchasing imported water for spreading. Between WY 2003/2004 and 2008/2009, the District was short 29,968 AF of planned imported water purchases for the spreading grounds. In 2009/2010 the District for the first time purchased untreated Tier 1 water for replenishment since the historical replenishment water was not available, including an extra 5,286 AF to help make-up some of the deficit. In the current year 2010/2011, the District has plans to purchase the normal 21,000 AF of spreading water plus an additional 3,500 AF to help makeup the deficit. This water will also be untreated Tier 1 water since discounted water remains

unavailable. The deficit at the start of ensuing year 2011/2012 will be 21,282 AF and the District will be considering reducing this amount by some margin in that year.

Table 9 presents the currently anticipated imported water replenishment needs.

Injection

Another way of replenishing the groundwater supply is to inject water at the three seawater intrusion barriers owned and operated by the LACDPW, including the West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier. Although the primary purpose of the barriers is for seawater intrusion control, groundwater replenishment also occurs as the freshwater is injected into the CWCB aquifers and then moves inland towards pumping wells.

To determine the amount of barrier water estimated for the ensuing year, WRD under an Agreement with LACDPW gets annual estimates from the expected demand at the barriers. WRD reviews these estimates and makes adjustments as necessary. For 2010/2011, no adjustments were made to estimates provided by the LACDPW, with the exception that their original 20,000 AF estimate for the West Coast Barrier was reduced to 18,000 AF based on current operating conditions.

For the West Coast Basin Barrier Project, 18,000 AF of demand is estimated, of which 10,000 AF is imported water and 8,000 AF is recycled water from WBMWD based on current delivery capabilities. For the Dominguez Gap Barrier Project, 7,400 AF are estimated, with 50% recycled water and 50% imported water. For the Alamitos Barrier on the WRD-side of the barrier, 6,200 AF are estimated with 50% recycled water and 50% imported water.

The total barrier demand for the ensuing year is estimated at 31,600 AF (**Table 9)**, including 14,800 AF recycled water (47%) and 16,800 AF imported water (53%).

In-Lieu Replenishment Water

The basic premise of WRD's In-Lieu Program is to offset the pumping in the basin to lower the annual overdraft and reduce the artificial replenishment needs. It helps provide an alternate means of replenishing the groundwater supply by encouraging basin pumpers to purchase surplus imported water when available instead of pumping groundwater. This can help raise water levels in areas that are otherwise more difficult to address. Since May 2007, the In-Lieu water has not been made available by MWD due to water shortages. However, WRD has planned for it in case the water became available. If monies raised go unspent, they are placed in a water purchase reserve for subsequent year water purchases. This concept was approved by the pumper's Technical Advisory Committee ("TAC") for the District in 2010 and will continue for ensuing year 2011/2012 at the same amount of 10,303 AF (6,000 AF in the Central Basin and 4,303 AF in the West Coast Basin).

Expected Availability of Replenishment Water

The availability of water supplies for the ensuing water year has been taken into account when determining how funds should be raised. If a particular resource is expected to be unavailable during a given year, money can still be raised to fund the purchase of that quantity of water in a succeeding year.

Groundwater Replenishment

Recycled Water

Recycled water is reliable all year round but its use is capped by regulatory limits. The current limits for recycled water spreading in the Montebello Forebay are established by the California Regional Water Quality Control Board (RWQCB) and are detailed in Order No. 91-100 adopted on September 9, 1991 with amendments on April 2, 2009 under Order No. R4-2009-0048. The District is limited to spreading 35% recycled water over a 5-year period based on the total inflow of all waters into the Montebello Forebay, meaning that at least 65% of the waters entering the forebay must be dilution waters such as storm water, underflow, rainfall, and imported water. As these dilution sources become scarce due to dry years or continued lack of imported replenishment water, the amount of recycled water will have to be reduced to maintain the 35% regulatory cap.

The Sanitation Districts of Los Angeles County (SDLAC) provides the recycled water to WRD for spreading by LACDPW. This water comes from the Whittier Narrows Water Reclamation Plant ("WNWRP"), San Jose Creek Water Reclamation Plant ("SJCWRP"), and Pomona Water Reclamation Plant ("PWRP"). WRD purchases water from the WNWRP and SJCWRP, whereas the water from the PWRP is considered incidental recharge and is not purchased. For planning purposes, the District assumes purchasing 50,000 AFY of recycled water each year to meet the regulatory cap. **Table 2** shows the breakdown amounts for these purchases.

Recycled water for injection into the seawater barrier wells comes from different agencies depending on the specific barrier. At the WCBBP, the water is provided by WBMWD's Edward C. Little Water Recycling Facility. Per regulatory limits, this resource can provide up to 75% of the water injected into the West Coast Basin Barrier with an increase up to 100% being planned. Because of recent operational issues at the treatment, only about 40% to 60% recycled water has been available to the barriers with imported water making up the difference. Since 18,000 AF is anticipated for the total barrier demand in the ensuing year, and 8,000 AF appears to be the current maximum capability for recycled water, imported demand is estimated at 10,000 AF.

Recycled water for the DGBP is available from the City of Los Angeles' Terminal Island Treatment Plant (Harbor Recycled Water Project). The plant is permitted to provide the barrier with up to 5 million gallons per day (mgd) or 5,600 AFY, or 50% of the total barrier supply, whichever is less. Since 7,400 AF is anticipated for the ensuing year, 3,700 AF will be recycled water and 3,700 AF will be imported water.

Recycled water for the ABP is available from WRD's Leo J. Vander Lans Water Treatment Facility. This treatment plant is permitted to provide up to 50% of barrier water with recycled water with the remainder being imported. Since 6,200 AF is anticipated for the ensuing year, 3,100 AF will be recycled water and 3,100 AF imported water.

Imported Water

All indications from MWD are that seasonal discounted spreading water and In-Lieu water will once again not be available in the ensuing year due to drought, environmental issues, and judicial decisions on the Bay Delta. As imported deliveries are cut back during dry years or with climate change or extended periods of drought, WRD may need to look at other sources for replenishment water, such as increased used of recycled water and storm water, or purchasing more expensive but more available imported water such as untreated Tier 1 (firm delivery) water. The purchase of

untreated Tier 1 water occurred for the first time in 2009/2010 and continued into 2010/2011 due to the continued unavailability of surplus water, and is expected to occur in the ensuing year.

For the imported water used for injection at the seawater barrier wells, the District pays the premium price for "non-interruptible" treated Tier 1 water meaning that it will be available all year long. Because of the increasing water costs at the barriers, the District is looking at ways to minimize costs such as reduction of pumping near the barriers, increased recycled water to offset imported water, or banking water at lower seasonal rates. At the ABP, the City of Long Beach and WRD have entered into an agreement to bank seasonal tre**a**ted water and Tier 1 water through inland injection wells and then extract the water for injection at the barriers when needed, thus saving considerable costs on barrier water. In 2009/2010, the 2,000 AF of Tier 1 water banked in 2008/2009 was utilized. The seasonal water banked in 2004/2005 through 2006/2007 has 2,160 AF remaining and can be called at any time that serves the District most effectively.

Projected Cost of Replenishment Water

WRD has estimated it will need 112,903 AF of replenishment water in the ensuing year. The MWD and their member agencies and the SDLAC set the price for the replenishment water WRD buys for the replenishment at the spreading grounds, barrier wells, and In-Lieu, and are a direct pass-through on WRD's replenishment assessment.

MWD in 2010 established a two-year budget with an anticipated price increase of around 7% for their water. MWD-member agencies such as CBMWD, WBMWD, and Long Beach have not yet set their rates so WRD does not know what their surcharges on the MWD water will be at this time. Over the next couple months, this information will become available and WRD will adjust its water cost estimates prior to adopting its replenishment assessment in May 2011.

Using currently available information and estimates for the cost of replenishment water to WRD in the ensuing year, the 112,903 AF required for purchase will cost approximately $42,156,493. This includes $16,100,428 for the spreading grounds, $22,356,257 for the seawater barrier injection wells, and $3,699,808 for In-Lieu water.

Tables 1 and 2 of the ESR provide a detailed breakdown of these costs.

These estimated costs are for anticipated water purchases only in the ensuing year for normal WRD operations. They do not include possible makeup water purchases to help overcome the Optimum Quantity deficit as discussed on page 2. Nor do they include the additional costs for projects and programs required to replenish the basins and to protect groundwater quality. These projects and programs are discussed in the next chapter. The anticipated costs for any makeup water and for the projects and programs to protect and preserve groundwater supplies in the District will be presented during the District's annual budgeting and rate setting process that will culminate in the Board's adoption of the 2011/2012 Replenishment Assessment in May 2011 effective July 1, 2011.

CHAPTER V
PROJECTS AND PROGRAMS

California Water Code Sections 60220 through 60226 describe the broad purposes and powers of the District to perform any acts necessary to replenish, protect, and preserve the groundwater supplies of the District. In order to meet its statutory responsibilities, WRD has instituted numerous projects and programs in a continuing effort to effectively manage groundwater replenishment and groundwater quality in the Central and West Coast Basins ("CWCB"). These projects and programs include activities that enhance the replenishment program, increase the reliability of the groundwater resources, improve and protect groundwater quality, and ensure that the groundwater supplies are suitable for beneficial uses.

These projects and programs have had a positive influence on the basins, and WRD anticipates continuing these activities into the ensuing year. The following is a discussion of the projects and programs that WRD intends to continue or initiate during the ensuing year.

001 – Leo J. Vander Lans Water Treatment Facility Project

The Leo J. Vander Lans Water Treatment Facility provides advanced treated recycled water to the Alamitos Seawater Intrusion Barrier. The facility receives tertiary-treated water from the Sanitation Districts and provides the advanced treatment through a process train that includes microfiltration, reverse-osmosis, and ultraviolet light. The facility's operations permit was approved by the Los Angeles Regional Water Quality Control Board on September 1, 2005, and the replenishment operations of this facility started in October 2005. The product water has since been discharging to the barrier to replace up to 50% of the potable imported water currently used, thereby improving the reliability and quality of the water supply to the barrier. The plant is designed to produce approximately 3,000 acre-feet per year (AFY) for delivery to the barrier. The Long Beach Water Department (LBWD) is responsible for operation and maintenance of the treatment plant under contract with WRD.

Preliminary engineering design is in progress to potentially expand the capacity of the facility so that it can provide up to 100% of the barrier water demands thereby eliminating the need for the imported water. Expected costs for the coming year will involve operation and maintenance of the plant, final design for plant expansion, as well as groundwater monitoring at the barrier. Because the primary purpose of this project is to provide a more reliable means of replenishing the basin through injection, 100% of the costs are considered to be drawn from the Replenishment Fund.

002 – Robert W. Goldsworthy Desalter Project

The Robert W. Goldsworthy Desalter has been operating since 2002 to remove brackish groundwater from a saline plume in the Torrance area that was stranded inland of the West Coast Basin Barrier after the barrier was put into operation in the 1950s and 1960s. The production well and desalting facility are located within the City of Torrance (City), and the product water is delivered for potable use to the City's distribution system. The treatment plan capacity is about 2,200 AFY. The City is responsible for operation and maintenance of the treatment plant under contract with WRD.

The District is evaluating the expansion of the treatment plant and plans to conduct feasibility studies for the expansion. Expected costs for the coming year will involve operation and maintenance of the plant and feasibility studies for the expansion. The purpose of the desalter is directly related to remediating degraded groundwater quality, and costs are thus attributed 100% to the Clean Water Fund.

Additional measures may be necessary in the future to fully contain and remediate the saline plume, which extends outside of the Torrance area. WRD is actively pursuing long-term solutions to this problem and continues to work with the City of Torrance Municipal Water Department, the pumpers' Technical Advisory Committee, and other stakeholders on the future of the saline plume removal in the West Coast Basin.

004 – Recycled Water Program

Recycled water (reclaimed municipal wastewater) has been used for groundwater recharge by WRD since 1962. Using recycled water to replenish the groundwater basins provides a reliable source of high quality water for surface spreading in the Montebello Forebay and injection at the seawater intrusion barriers. In view of the drought conditions that periodically occur in California and uncertainty in the future availability and cost of imported supplies, this resource has become increasingly vital as a replenishment source.

WRD participates in various research and testing activities to ensure that the use of recycled water continues to be a safe and reliable resource for groundwater recharge. WRD, along with other stakeholders, is working closely with the California Department of Public Health ("CDPH") to review and revise regulations on groundwater recharge using recycled water. Through this dialogue, WRD and CDPH exchange information and develop a mutual understanding of each agency's perspectives.

From an operational standpoint, the District continues to coordinate with the SDLAC with permit compliance activities, including groundwater monitoring and reporting, to ensure that the current practice and operation of replenishing with recycled water continues to be safe. Many monitoring wells and production wells are sampled frequently by WRD staff, and the results are reported as required to the regulatory agencies.

In addition to regular monitoring and sampling around the spreading grounds, WRD is partnering with others to more fully investigate the effectiveness of soil aquifer treatment ("SAT") during recharge activities. Research is being conducted by specialists and experts and includes specific tests to characterize the percolation process and quantify the filtering and purifying properties of the underlying soil on constituents of concern such as nitrogen, total organic carbon, and emerging chemicals of concern (CECs). The District continues to be vigilant in monitoring research on the detection, significance, and treatment of CECs, such as pharmaceuticals and personal care products.

Three separate groundwater tracer studies to track and verify the movement of water from the spreading grounds and monitoring wells and production wells have been performed in 2003-2005, 2005-2006, and 2010-2011. Results showed that it is the depth and not the horizontal distance from the recharge ponds that is the key factor in arrival times of water to wells (travel time to deeper wells is greater than to shallower wells, even if the deeper wells are very near the spreading grounds). In some cases, WRD made modifications to wells to seal off their shallow perforations so that the wells

only produced from the deeper aquifers. The tracer tests were then repeated to demonstrate that the travel time had been increased. These efforts, in addition to periodic studies assessing health effects and toxicological issues, are necessary to provide continued assurances that recycled water for groundwater recharge remains safe and compliant with regulatory standards in the local basins.

Recycled water is also injected into the three seawater intrusion barriers in Los Angeles County (Alamitos, West Coast Basin, and Dominguez Gap). Work associated with the use of recycled water at those facilities is maintained under the specific project (e.g., Leo J. Vander Lans Water Treatment Facility) that delivers that resource to the barriers or under the program related to recycled water use at the specified barrier.

Projects under this program help to improve the reliability and utilization of an available local resource. This resource is used to improve replenishment capabilities and is thus funded 100% from the Replenishment Fund.

005 – Groundwater Resources Planning Program

The Groundwater Resources Planning Program was instituted to evaluate basin management issues and to provide a means of assessing project impacts over the CWCB. Prior to moving forward with a new project, an extensive evaluation is undertaken. Within the Groundwater Resources Planning Program, new projects and programs are analyzed based on benefits to overall basin management. This analysis includes performing an extensive economic evaluation to compare estimated costs with anticipated benefits. As part of this evaluation process, all new capital projects are brought to the District's Technical Advisory Committee for review and recommendation.

One of the main programs currently underway under this Program is a Master Plan of the two groundwater basins. Efforts are underway to interview groundwater producers in these two basins to identify future pumping demands so that the District can be prepared for future replenishment needs. Also under this program, District staff will continue to monitor State and Federal funding programs to determine applicability to the District's list of potential projects. In the coming year, the District will continue participation in Integrated Regional Water Management Planning ("IRWMP") for Greater Los Angeles County. Collaborative development of the region's IRWM plan is a requirement for entities to secure grant funding under Proposition 84 and Proposition 1E which were passed in November 2006. It is expected that this plan will play a significant role in future grant funding opportunities at the Local, State and Federal levels. District staff will also monitor the ongoing AB303 and WaterSMART grant funding programs.

Projects under the Groundwater Resources Planning Program serve to improve replenishment operations and general basin management. Accordingly, this program is also wholly funded through the Replenishment Fund.

006 – Groundwater Quality Program

This comprehensive program constitutes an ongoing effort to address water quality issues that affect WRD projects and the pumpers' facilities. The District monitors and evaluates the impacts of proposed, pending and recently promulgated drinking water regulations and proposed legislation. The District assesses the justification and reasoning used to draft these proposals and, if warranted, joins in coordinated efforts with other interested agencies to resolve concerns during the early phases of the regulatory and/or legislative process.

The District continually evaluates current and proposed water quality compliance in production wells, monitoring wells, and spreading/injection waters of the basins. If noncompliance is identified, WRD staff quickly investigates to determine the causes of noncompliance, develops recommended courses of action and estimates their associated costs to address the problem, and implements the best alternative to achieve compliance.

Effective January 1, 2007, the District assumed responsibility for the Central Basin Title 22 Groundwater Monitoring Program that had been administered previously by the Central Basin Municipal Water District. This program provides services for monitoring of drinking water wells as required by state statutes to ensure that they continue to be safe for domestic use. Currently, twenty pumpers with 80 wells are participating in this program. In addition, a new contract for sample collection and laboratory analysis was issued for this work. This program is paid for by the participants, and therefore, does not impact the District's replenishment assessment.

In recent years, new CECs have been identified as potentially impacting local surface water and groundwater, not only in the CWCB but also in neighboring regions such as the Main San Gabriel Basin, Orange County Basin, Chino Basin, etc. Constituents such as perchlorate, n-nitroso dimethylamine (NDMA), hexavalent chromium, and 1,4-dioxane have emerged as CECs and may pose a potential threat to the local resources; although just their detection in the environment does not mean that they pose a public health threat at their measured concentrations. Monitoring associated with surface spreading groundwater recharge facilities may increase, specifically for CECs pending future adoption of a resolution by the State Water Resources Control Board regarding its Scientific Advisory Panel's recommendations for monitoring CECs in recycled water.

WRD's service area contains a large and diverse industrial and commercial base. Consequently, many potential groundwater contamination sources exist within District boundaries. Examples of potential contamination sources include leaking underground storage tanks, petroleum pipeline leaks at refineries and petrochemical plants, and discharges from dry cleaning facilities, auto repair shops, metal works facilities, and others. Such contamination sources may pose a threat to the drinking water aquifers. Accordingly, WRD established its Groundwater Contamination Prevention Program as a key component of the Groundwater Quality Program, in an effort to minimize or eliminate threats to groundwater supplies.

The Groundwater Contamination Prevention Program includes several ongoing efforts:

- Central and West Coast Basin Groundwater Contamination Forum: More than seven years ago, WRD established this data-sharing and discussion forum with key stakeholders including the U.S. Environmental Protection Agency ("USEPA"), the California Department of Toxic Substances Control ("DTSC"), the California Regional Water Quality Control Board – Los Angeles ("RWQCB-LA"), the California Department of Public Health ("CDPH"), the U.S. Geological Survey ("USGS"), and various cities and pumpers. Stakeholders drafted and signed a Memorandum of Understanding ("MOU") agreeing to meet regularly (meetings are held 3 to 4 times per year at WRD) and share data on contaminated groundwater sites within the District. WRD has acted as the meeting coordinator and data repository/distributor, helping stakeholders to characterize the extent of contamination to identify pathways for ~~shallow~~ contaminants in shallow aquifers to reach

deeper drinking water aquifers and develop optimal methods for remediating contaminated groundwater.

- With the cooperation and support of all stakeholders in this Forum, WRD developed a list of high-priority contaminated groundwater sites within the District. This list is a living document, subject to cleanup and "closure" of sites, as well as discovery of new sites warranting further attention. Currently, the list includes over 45~~0~~ sites across the CWCB. WRD works with the lead regulatory agencies for each of these sites to keep abreast of their status, offer data collection, review and recommendations as needed, and facilitate progress in site characterization and cleanup.

- In 2003, WRD developed a scope of work with the Los Angeles County Department of Health Services ("LACDHS") to clarify the status of 217 potentially abandoned (a.k.a., "unknown status") wells located within District boundaries, as identified through researching WRD's groundwater production database. WRD completed numerous tasks to determine the status of these wells, including: distributing, collecting and tallying a survey questionnaire to all well owners associated with the potentially abandoned wells; searching through thousands of hard-copy well construction and destruction permits at the DWR, LACDHS, and City of Long Beach; conducting field reconnaissance trips to locate and photograph wells. These efforts were successful: WRD was able to reduce the number of "unknown status" wells from 217 to 20, and most of the remaining 20 are suspected to have been paved over during development of industrial and residential neighborhoods. At this time, WRD is reviewing its groundwater production database, to identify any new "unknown status" wells~~,~~ and to repeat the tasks listed above to clarify their status.

- Beginning in April 2010, WRD commenced work with the U.S. Geological Survey on the Central Basin Groundwater Contamination Study. The purpose of this study is to characterize the threat of multiple contaminant plumes moving downward through any preferential pathways to deeper potable aquifers in the Central Basin. The study area encompasses a large portion of the Central Basin, including the locations of several high-priority contaminated groundwater sites. Study tasks include compilation of existing data, sequence stratigraphic analysis, water quality sampling, geochemical analyses, and characterization of the groundwater flow system. The study is expected to be completed at the end of 2011. WRD received AB303 grant funding to support this project.

WRD is also participating in the Water Augmentation Study ("WAS") of the Los Angeles and San Gabriel Rivers Watershed Council. This is a multi-year investigation to evaluate the feasibility of capturing more storm runoff at localized sites in lieu of discharge into the storm drains, channels, and ultimately to the ocean. It is a potential source of new replenishment water~~,~~ and would be in addition to stormwater currently captured and retained for percolation at the existing spreading grounds within the District. The underlying concept for the WAS is to retain more stormwater rather than allow it to be lost to the ocean; however, precautions must be taken to ensure that this new water does not degrade groundwater quality if allowed to percolate at local sites. More stormwater could be saved by utilizing Best Management Practices (BMPs), e.g., bioswales, infiltration basins, and porous pavements. Much of the WAS is focused on evaluating the technical feasibility of this project and the potential impacts on groundwater quality. Other aspects of the WAS include modeling to estimate the amount of water that can be percolated in the local watershed and the

economic value of this additional source of water. In 2009, the Elmer Avenue neighborhood BMP demonstration project was constructed to evaluate the effectiveness and potential of a large-scale project. Extensive monitoring of the BMP demonstration project is planned for the coming years to assess the effectiveness of the BMPs in water capture and maintaining or improving groundwater quality.

Much of the work for the coming year will involve additional investigations at well sites known to have contaminated water, continued monitoring of water quality regulations and proposals affecting production and replenishment operations, further characterization of contaminant migration into the deeper aquifers, and monitoring and expediting cleanup activities at contaminated sites. All work under this program is related to water quality and cleanup efforts; therefore, 100% of it is funded from the Clean Water Fund.

010 – Geographic Information System (GIS)

The District maintains an extensive database and Geographic Information System (GIS) in-house. The database includes water level and water quality data throughout the entire WRD service area with information drawn not only from the District's Regional Groundwater Monitoring Program and permit compliance monitoring, but also from water quality data obtained from the CDPH. The system requires continuous update and maintenance but serves as a powerful tool for understanding basin characteristics and overall basin health.

The GIS is used to provide better planning and basin management. The system is used to organize and store an extensive database of spatial information, including well locations, water level data, water quality information, well construction data, production data, aquifer locations, and computer model files. Staff uses the system daily for project support and database management. Specific information is available to any District pumper or stakeholder upon request and can be delivered through the preparation of maps, tables, reports, or other compatible format. Additionally, the District has made its web-based Interactive Well Search tool available to selected users. This web site provides these users with limited access to WRD's water quality and production database.

District staff will continue to streamline and refine the existing data management system and website as well as satisfy both internal and external data requests. As part of the streamlining of the data, staff will fully automate the transfer of water quality data from the laboratory directly into the District's water quality database. Additionally, District staff will continue the development of applications to more efficiently manage and report groundwater production information. Continued use, upkeep, and maintenance of the GIS are planned for the coming year. The use of the system supports both replenishment activities and groundwater quality efforts. Accordingly, the cost for this program is equally split between the Replenishment and Clean Water Funds.

011 – Regional Groundwater Monitoring Program

WRD has been monitoring groundwater quality and water levels in the CWCB for over 50 years. The Regional Groundwater Monitoring Program provides for the collection of basic information used for groundwater basin management including groundwater level data and water quality data. It currently consists of a network of nearly 300 WRD and USGS-installed monitoring wells at over 50 locations throughout the District, supplemented by the existing groundwater production wells. The information generated by this program is stored in the District's GIS and provides the basis to better understand the dynamic changes in the Central and West Coast Basins. WRD staff, comprised of

hydrogeologists and engineers, provides the in-house capability to collect, analyze and report groundwater data.

Water quality samples from the monitoring wells are collected twice a year. Water levels are measured in most monitoring wells with automatic data loggers daily, while water levels in all monitoring wells are measured by WRD field staff a minimum of four times per year. On an annual basis, staff prepares a report that documents groundwater level and groundwater quality conditions throughout the District.

Most of the work during the coming year will involve continuous field activities including quarterly and semi-annual data collection, continuous well and equipment maintenance, and annual reporting activities. In addition, new nested monitoring wells will be constructed. Work associated with the Regional Groundwater Monitoring Program also supports activities relating to both replenishment and water quality projects. The program, therefore, is funded 50% each from the Replenishment and Clean Water Funds.

012 – Safe Drinking Water Program

WRD's Safe Drinking Water Program ("SDWP") has operated since 1991 and is intended to promote the cleanup of groundwater resources at specific well locations. Through the installation of wellhead treatment facilities at existing production wells, the District hopes to remove contaminants from the underground supply and deliver the extracted water for potable purposes. Projects implemented through this program are accomplished through direct input and coordination with well owners. Two treatment facilities were constructed in 2010. Both treatment systems were constructed for the removal of iron and/or manganese. The removal mechanism is a pressurized filtration system.

The current program focuses on the removal of VOCs and offers financial assistance for the design and equipment of the selected treatment facility. Another component of the program offers no-interest loans for other constituents of concern that affect a specific production well. The capital costs of wellhead treatment facilities range from $800,000 to over $2,000,000. Due to financial constraints, this initial cost is generally prohibitive to most pumpers. Financial assistance through the District's SDWP makes project implementation much more feasible.

There are several current projects in various stages of completion and new candidates for participation are on the rise. A total of fifteen (15) facilities are already completed and online and one facility has successfully completed removal of the contamination and no longer needs treatment. While continued funding of this program is anticipated for next year, the District has revised the guidelines of the SDWP to place a greater priority on projects involving VOC contamination or other anthropogenic (man-made) constituents, now classified as Priority A Projects. Further, any treatment projects for naturally-occurring constituents would be classified as Priority B Projects and funded on a secondary priority, on a case-by-case basis, and only if program monies are still available during the fiscal year. While such projects are of interest to WRD, availability of funding for them will not be determined until after the budget process.

Projects under the SDWP involve the treatment of contaminated groundwater for subsequent beneficial use. This water quality improvement assists in meeting the District's groundwater

cleanup objectives. Thus, funding for the costs of the program is drawn wholly from the Clean Water Fund.

018 – Dominguez Gap Barrier Recycled Water Injection

This Project involves the delivery of recycled water from the City of Los Angeles Department of Water and Power's ("LADWP") Terminal Island Treatment Plant ("TITP") Advanced Water Treatment Facility ("AWTF") to the Dominguez Gap Barrier ("DGB"). Deliveries of recycled water to the barrier commenced in late February 2006 and have continued into 2011.

This water is being treated with microfiltration, reverse osmosis, and chlorination before being injected into the DGB. The project is permitted to maintain an overall ratio of 50% recycled water and 50% potable water to the entire barrier to satisfy regulatory requirements. Additional water quality requirements, including turbidity and modified fouling index ("MFI"), must also be met to minimize potential fouling of injection wells in the DGB, which is owned and operated by the County of Los Angeles Department of Public Works.

While LADWP is responsible for the treatment and delivery of the recycled water and all the water quality sampling associated with those activities, WRD has responsibility over groundwater monitoring compliance. As part of the permit, groundwater monitoring is required to observe water quality conditions and to anticipate potential problems before recycled water travels to downgradient drinking water wells. In addition, a tracer study was conducted at the start of recycled water injection (February 2006) through fall 2010 to determine the extent of travel and movement of the recycled water blend. The tracer study confirmed that adequate mixing and further blending in the ground is occurring and that groundwater samples being collected are representative of the recycled water blend.

Recycled water use at the seawater intrusion barriers in Los Angeles County improves the reliability of a supply that is needed on a continuous basis. Traditionally, water purchases for the barriers have been viewed as a replenishment function. Therefore, this program is funded 100% through the Replenishment Fund.

023 – Replenishment Operations

WRD actively monitors the operation and maintenance practices at the LACDPW-owned and operated spreading grounds and seawater barriers within the District. Optimizing replenishment opportunities is fundamentally important to WRD, in part because imported and recycled water deliveries directly affect the District's annual budget. Consequently, the District seeks to ensure that the conservation of stormwater is maximized, and that imported and recycled water replenishment is optimized.

Due to the reduction and unreliability of imported water for replenishment, WRD is working on its Water Independence Now ("WIN") program to eventually become independent from imported water for groundwater recharge. Currently, the District needs about 31,000 AF of imported water for recharge; 21,000 AF for spreading and 10,000 AF for injection at the seawater barriers. By maximizing the use of recycled water and stormwater, the amount of imported water can eventually be reduced or eliminated, thereby providing the groundwater basins with full replenishment needs through locally-derived water.

WRD coordinates regular meetings with LACDPW, MWD, SDLAC, and other water interests to discuss replenishment water availability, spreading grounds operations, scheduling of replenishment deliveries, seawater barrier improvements, upcoming maintenance activities, and facility outages or shutdowns. The District tracks groundwater levels in the Montebello Forebay weekly to assess general basin conditions and determine the level of artificial replenishment needed. WRD also monitors the amount of recycled water used at the spreading grounds and seawater barriers to maximize use while complying with pertinent regulatory limits.

Recently, the District worked with LACDPW to complete construction of the Interconnection Pipeline. This jointly-funded project is a new, dedicated pipeline and pumping station constructed between the Rio Hondo and San Gabriel Coastal Spreading Grounds to transfer replenishment water in either direction, via gravity flow from the Rio Hondo to San Gabriel or pumping in the reverse direction. The project is expected to conserve approximately 1,300 AFY of additional stormwater on average, help maximize the amount of recycled water conserved by approximately 5,700 AFY, and provide operational flexibility to mitigate obstacles to performing replenishment at these spreading grounds. The Interconnection Pipeline project is a key component of the District's WIN.

While improvements undertaken in recent years by LACDPW/WRD (e.g., expansion of Whittier Narrows Conservation Pool, installation of rubber dams on San Gabriel River, Interconnection Pipeline) have considerably increased the stormwater portion of WRD's supply portfolio, the potential for further increasing the use of stormwater for groundwater augmentation remains significant. Results of the Water Augmentation Study (described under Project 006 above) suggest that nearly 180,000 AFY of stormwater runoff is lost to the ocean from WRD's service area. Accordingly, the District plans to work with the LASGRWC on the Stormwater Recharge Feasibility Study and Pilot Project Development effort. This effort will identify regional and parcel-based locations and pilot project concepts and their respective costs and benefits within the District to achieve maximum stormwater capture for water supply benefit. Existing but independent analyses, datasets and modeling tools will be combined to identify where potential pilot projects may be located and to provide concept designs within a focused area. The study will identify with great specificity the best locations for stormwater capture and filtration and the technologies best suited to the locations.

As its name implies, this program deals primarily with replenishment issues and its costs are borne completely by the Replenishment Fund.

025 – Hydrogeology Program

This program accounts for the projects and programs related to hydrogeologic investigations of the District and surrounding areas to ensure safe and reliable groundwater. Work performed under this program includes the preparation of the annual Engineering Survey and Report, which incorporates the calculation and determination of annual overdraft, accumulated overdraft, change in storage, pumping amounts, and replenishment water availability into a document to help the District assess its replenishment needs and costs in the ensuing year. Extensive amounts of data are compiled and analyzed by Staff to determine these values. Maps are created showing water levels in the basins and production patterns and amounts. The updates, maintenance, and use of the Regional Groundwater Flow Model developed by the USGS and WRD are part of this program. This model is a significant analytical tool utilized by WRD to determine basin benefits and impacts of changes proposed in the management of the Central and West Coast Basins.

Projects and Programs

An ongoing effort at the District to better characterize the hydrogeologic conditions across the Central and West Coast Basins is called the "Hydrogeologic Conceptual Model". This long-term project involves compiling and interpreting the extensive amounts of data generated during drilling and logging of the WRD/USGS monitoring wells, and collected from historical information for production wells and oil wells within the District. The ultimate goal of this project is to incorporate these data in WRD's database/GIS and apply the system to generate aquifer surfaces and cross-sections for comparison with historical interpretations of basin hydrogeology. The final conceptual model will significantly improve the understanding of the aquifer depths, extents, and thicknesses throughout the District, and will assist Staff, pumpers and stakeholders with planning for groundwater resource projects such as new well drilling, storage opportunities, or modeling. The data will also be made available on WRD's website to be used as a reference source for hydrogeologic interpretations and fulfilling project-related data requests.

Hydrogeologic analysis is also needed for projects associated with groundwater quality concerns and specific cleanup projects. Staff work may include investigative surveys, data research, and oversight of specific project studies. Such efforts are used to relate water quality concerns with potential impact to basin resources. An example of this type of Staff work is the District's Well Profiling Program. The District assists pumpers in evaluating drinking water supply well contamination. Services may include existing data collection and review, and field tasks such as spinner logging and depth-discrete sampling. WRD's evaluation helps pumpers to determine the best course of action; e.g., sealing off a particular screened interval of a well, wellhead treatment, or well destruction.

Salt / Nutrient Management Plans are a new State requirement for all groundwater basins throughout California. The Plans are required as part of the Recycled Water Policy issued by the State Water Resources Control Board (SWRCB) and effective as of May 14, 2009. As stated in the Policy, its purpose is to "establish uniform requirements for recycled water use and to develop sustainable water supplies throughout the state". The SWRCB therefore "supports and encourages every region…to develop a Salt / Nutrient Management Plan by 2014". With one exception (elevated TDS concentrations near the coast due to historic seawater intrusion, now controlled through freshwater barrier injection), salts and nutrients have not been shown to be a concern in the CWCB. However, since Salt / Nutrient Management Plans are required, WRD began meeting with other stakeholders and the Regional Water Quality Control Board (RWQCB, the agency responsible for bringing stakeholders' Salt / Nutrient Management Plans to the SWRCB for approval) to initiate development of a Salt / Nutrient Management Plan for the CWCB. WRD will continue to take the lead in working with the RWQCB and stakeholders to develop a Plan for the CWCB.

For the ensuing year, it is expected that additional investigative research projects into the saline plume, well testing, and recycled water travel time using tracers will be performed. In 2011/2012, a major update to the regional groundwater flow model will continue to be performed by the USGS to incorporate 8 years of new information since the model was last updated.

The Hydrogeology Program addresses both groundwater replenishment objectives and groundwater quality matters. This dual service warrants that the cost of the program be split evenly between the Replenishment and Clean Water Funds.

033 – Groundwater Reliability Improvement Program ("GRIP")

The WRD continues to pursue projects through its WIN program that develop local, sustainable sources of water for use in groundwater replenishment. This has become increasingly important in light of the environmental and political issues limiting delivery of imported water to Los Angeles area together with the potential for a drought to hit California.

To address these issues WRD is seeking alternative sources of water to offset the imported water used for replenishment in the Montebello Forebay. This program is referred to as the Groundwater Reliability Improvement Program (GRIP). The effort of this program is to evaluate all feasible alternatives for replacing or offsetting the current quantity of imported water used for replenishment. One alternative being considered is the use of advanced treated recycled municipal wastewater (microfiltration, reverse osmosis, ultra-violet light with hydrogen peroxide.) from the Sanitation Districts of Los Angeles County's (SDLAC) San Jose Creek Water Reclamation Plant.

To determine the viability of this concept, in 2009 WRD entered into a partnership with the Upper San Gabriel Valley Municipal Water District ("USGVMWD") and the SDLAC to share in the cost for a consultant to perform a conceptual design of a facility for the purpose of developing preliminary cost estimates. The concept will be to deliver advanced treated water to the San Gabriel River spreading basins to meet a portion of WRD's replenishment requirements along with delivery to proposed spreading basins near the Santa Fe Dam to help satisfy the needs of the USGVMWD.

Upon finding the concept feasible, the same partners have more recently created a Joint Powers Authority (JPA) to fund a consultant to perform an Alternatives Analysis to evaluate various options in addition to the proposed treatment facility in order to bring replenishment water to the spreading grounds. This effort is expected to be completed in early 2011. The JPA has also hired an outreach consultant to educate and solicit input from the pumping community, elected officials, non-governmental organizations, as well as the general public. Any new source of replenishment water developed through the GRIP will help to improve the reliability and utilization of an available local resource. This resource is used to improve replenishment capabilities and is thus funded 100% from the Replenishment Fund.

TABLES

Table 1

GROUNDWATER CONDITIONS AND REPLENISHMENT SUMMARY

ITEM	WATER YEAR Oct 1 - Sep 30		
	2009-2010	*2010-2011 (a)*	*2011-2012 (a)*
Total Groundwater Production	241,329 AF	241,000 AF	243,000 AF
Annual Overdraft	(84,200) AF	(80,800) AF	(97,800) AF
Accumulated Overdraft	(726,300) AF	(703,600) AF	

Quantity Required for Artificial Replenishment for the Ensuing Year		
Spreading		
Imported for Spreading in Montebello Forebay	21,000	AF
Recycled for Spreading in Montebello Forebay	50,000	
Subtotal Spreading	71,000	
Injection		
Alamitos Seawater Barrier Imported Water (WRD side only)	3,100	
Alamitos Seawater Barrier Recycled Water (WRD side only)	3,100	
Dominguez Gap Seawater Barrier Imported Water	3,700	
Dominguez Barrier Seawater Barrer Recycled Water	3,700	
West Coast Seawater Barrier Imported Water	10,000	
West Coast Seawater Barrier Recycled Water	8,000	
Subtotal Injection	31,600	
In-lieu (b) Subtotal In-lieu	10,303	
Total	**112,903**	AF

Source and Unit Cost of Replenishment Water for the Ensuing Year						
Spreading		**Oct-Dec**			**Jan-Sep**	
MWD Commodity Rate for Tier 1 Untreated Imported	*$*	*527*	*/AF*	*$*	*560*	*/AF*
CBMWD Administrative Surcharge	*$*	*90*	*/AF*	*$*	*90*	*/AF*
*CBMWD Readiness to Serve (RTS) charge **	*$*	*26*	*/AF*	*$*	*26*	*/AF*
Cost to WRD (sum of above)	**$**	**644**	**/AF**	**$**	**677**	**/AF**
plus CBMWD Water Service Charge	$	72	/cfs/mo	$	72	/cfs/mo
SDLAC recycled water from San Jose Creek	$	34.40	/AF	$	34.40	/AF
SDLAC recylced water from Whittier Narrows WRP	$	7	/AF	$	7	/AF
SDLAC makeup for undercharges in 2007-2009	$	19,074.86	/mo	$	19,074.86	/mo
Injection						
Alamitos Barrier						
MWD Commodity Rate for Tier 1 Treated Imported	*$*	*744*	*/AF*	*$*	*794*	*/AF*
Long Beach Administrative Surcharge	*$*	*5*	*/AF*	*$*	*5*	*/AF*
Cost to WRD (sum of above)	**$**	**749**	**/AF**	**$**	**799**	**/AF**
plus Long Beach Capacity Charge *	$	600	/cfs/mo	$	600	/cfs/mo
Recycled water from WRD Vander Lans plant	$	406	/AF	$	406	/AF
Dominguez Gap and West Coast Barriers						
MWD Commodity Rate for Tier 1 Treated Imported	*$*	*744*	*/AF*	*$*	*794*	*/AF*
WBMWD Administrative Surcharge	*$*	*85*	*/AF*	*$*	*85*	*/AF*
*WBMWD RTS **	*$*	*125*	*/AF*	*$*	*166*	*/AF*
Cost to WRD (sum of above)	**$**	**954**	**/AF**	**$**	**1,045**	**/AF**
plus WBMWD Water Service Charge	$	41	/cfs/mo	$	41	/cfs/mo
plus WBMWD Capacity Charge *	$	529	/cfs/mo	$	529	/cfs/mo
Recycled water from LADWP (Dominguez Gap)	$	431	/AF	$	431	/AF
Recycled water from WBMWD (West Coast)	$	567	/AF	$	567	/AF
In-lieu (b) MWD Member Agency				$	336	/AF
WBMWD Customer				$	421	/AF

(a) Estimated values

(b) Amounts and rates for In-lieu are estimated. Not yet been established by the Board for ensuing year

** Amount is a direct pass through to MWD*

Table 2

QUANTITY AND COST OF REPLENISHMENT WATER FOR WY 2010-2011

Summary - All Water

Item	Quantity (AF)	Total Cost
Spreading - Tier 1 Untreated Imported	21,000	$ 14,425,530
Spreading - Recycled	50,000	$ 1,674,898
Alamitos Barrier - Imported	3,100	$ 2,468,390
Alamitos Barrier - Recycled*	3,100	$ -
Dominguez Barrier - Imported	3,700	$ 3,722,765
Dominguez Barrier - Recycled	3,700	$ 1,594,700
West Coast Barrier - Imported	10,000	$ 10,034,402
West Coast Barrier - Recycled	8,000	$ 4,536,000
In-Lieu MWD Member	7,503	$ 2,521,008
In-Lieu WBMWD Customer	2,800	$ 1,178,800
TOTAL	**112,903**	**$ 42,156,493**

Detailed Breakout of Water Costs and Surcharges to WRD

Item	Quantity	Oct-Dec	Jan-Sep	Melded	Total
Imported Water					
CBMWD					
MWD Untreated Tier 1 - Spreading ($/af)	21,000	$ 527	$ 560	$ 552	$ 11,586,750
MWD RTS ($/af)	21,000	$ 26	$ 26	$ 26	$ 551,250
CBMWD Administrative Surcharge ($/af)	21,000	$ 90	$ 90	$ 90	$ 1,896,300
CBMWD Water Service Charge ($/cfs/month)	450	$ 72	$ 72	$ 72	$ 391,230
Total to CBMWD					**$ 14,425,530**
LBWD					
MWD Treated Tier 1 - Alamitos Barrier ($/af)	3,100	$ 744	$ 794	$ 782	$ 2,422,650
MWD Capacity Charge ($/cfs/month)	4.20	$ 600	$ 600	$ 600	$ 30,240
LBWD Administrative Surcharge ($/af)	3,100	$ 5	$ 5	$ 5	$ 15,500
Total to LBWD					**$ 2,468,390**
WBMWD					
MWD Tier 1 - Barriers (DG,WCB) ($/af)	13,700	$ 744	$ 794	$ 782	$ 10,706,550
MWD RTS ($/af)	13,700	$ 94	$ 125	$ 117	$ 1,606,325
MWD Capacity Charge ($/cfs/month)	34	$ 529	$ 529	$ 529	$ 215,832
WBMWD Administrative Surcharge ($/af)	13,700	$ 85	$ 85	$ 85	$ 1,164,500
WBMWD Water Service Charge ($/cfs/month)	130	$ 41	$ 41	$ 41	$ 63,960
Total to West Basin MWD					**$ 13,757,167**
IN-LIEU				IL-PMT	
MWD Member Agency ($/af)	7,503	-	-	$ 336	$ 2,521,008
WBMWD Member Agency ($/af)	2,800	-	-	$ 421	$ 1,178,800
Total for In-Lieu Payments					**$ 3,699,808**
Recycled Water					
LADWP					
LADWP Recycled Water ($/af)	3,700	$ 431	$ 431	$ 431	$ 1,594,700
Total to LADWP					**$ 1,594,700**
SDLAC					
SDLAC - San Jose Creek WRP ($/af)	40,000	$ 34	$ 34	$ 34	$ 1,376,000
SDLAC - Whittier Narrows WRP ($/af)	10,000	$ 7	$ 7	$ 7	$ 70,000
SDLAC - Makeup Payment ($)					$ 228,898
Total to SDLAC					**$ 1,674,898**
WBMWD					
WBMWD Recycled Water ($/af)	8,000	$ 567	$ 567	$ 567	$ 4,536,000
Total to WBMWD					**$ 4,536,000**
WRD					
WRD Recycled Water Vander Lans ($/af)	3,100	$ 406	$ 406	$ 406	**$ 1,258,600**
WRD Recycled Water Vander Lans ($/af)*	3,100	$ 406	$ 406	$ 406	**$ (1,258,600)**
Total to WRD					**$ -**
TOTAL					**$ 42,156,493**

* Cost is based on O&M less MWD rebate. Shown as a water cost but deducted out since it's part of the Vander Lans project

Table 3

WRD PROJECTS AND PROGRAMS

PROJECT / PROGRAM	DISTRICT FUNCTION	
	Replenishment	Clean Water
001 Leo J. Vander Lans Water Treatment Facility Project	100%	
002 Robert W. Goldsworthy Desalter Project		100%
004 Recycled Water Program	100%	
005 Groundwater Resources Planning Program	100%	
006 Groundwater Quality Program		100%
010 Geographic Information System	50%	50%
011 Regional Groundwater Monitoring Program	50%	50%
012 Safe Drinking Water Program		100%
018 Dominguez Gap Barrier Recycled Water Injection	100%	
023 Replenishment Operations (Spreading & Barriers)	100%	
025 Hydrogeology Program	50%	50%
033 Groundwater Resources Improvement Program (GRIP)	100%	0%

Table 4

30-YEAR AVERAGE GROUNDWATER BALANCE
FROM USGS & WRD REGIONAL MODEL

INFLOWS	Average AFY	OUTFLOWS	Average AFY
Natural Inflows:		**Artificial Outflows:**	
Local water conserved at spreading grounds [1]	48,825	Pumping	250,590
Interior and mountain front recharge	47,900		
Net underflow from adjacent basins [2]	48,480		
Subtotal Natural Inflows:	145,205		
Artificial Inflows:			
Imported and recycled spreading [3]	74,075		
Barrier injection water [4]	34,600		
Subtotal Artificial Inflows:	108,675		
Total Inflows:	**253,880**	**Total Outflows:**	**250,590**

Average Annual Groundwater Deficiency (afy) = Natural Inflows - Total Outflows = (105,385)

[1] includes stormwater and base flow water captured and recharged at the spreading grounds

[2] does not include average of 7,100 afy of seawater intrusion, which can not be considered as replenishment per the water code

[3] includes all imported purchased, all recycled purchased, and Pomona Plant (free) recycled water.

[4] includes all injected water at the three barrier systems, including all of Alamitos Barrier. Model value may differ slightly from actual purchases.

Description of the model can be found in USGS, 2003, Geohydrology, Geochemistry, and Ground-Water Simulation - Optimization of the Central and West Coast Basins, Los Angeles County, California; Water Resources Investigation Report 03-4065 by Reichard, E.G., Land, M., Crawford, S.M., Johnson, T., Everett, R.R., Kulshan, T.V., Ponti, D.J., Halford, K.J., Johnson, T.A., Paybins, K.S., and Nishikawa, T.

Table 5

HISTORICAL RAINFALL

Station #107D, Downey Fire Department

Water Year	Inches	Water Year	Inches	Water Year	Inches	Water Year	Inches
1925-26	12.63	1950-51	8.27	1975-76	9.55	2000-01	14.98
1926-27	16.92	1951-52	24.68	1976-77	11.23	2001-02	2.52
1927-28	11.97	1952-53	10.53	1977-78	33.85	2002-03*	19.89
1928-29	11.52	1953-54	12.33	1978-79	18.68	2003-04	7.73
1929-30	10.84	1954-55	11.84	1979-80	28.29	2004-05	23.43
1930-31	10.45	1955-56	13.97	1980-81	8.74	2005-06	11.36
1931-32	14.52	1956-57	9.89	1981-82	13.41	2006-07	1.95
1932-33	10.02	1957-58	24.65	1982-83	30.3	2007-08	17.11
1933-34	11.1	1958-59	6.68	1983-84	11.96	2008-09	9.49
1934-35	21.94	1959-60	9.84	1984-85	12.44	2009-10	10.42
1935-36	9.65	1960-61	4.3	1985-86	19.47		
1936-37	22.11	1961-62	18.46	1986-87	6.49		
1937-38	21.75	1962-63	10.9	1987-88	11.47		
1938-39	18.69	1963-64	6.86	1988-89	7.82		
1939-40	12.81	1964-65	13.27	1989-90	7.87		
1940-41	34.21	1965-66	17.02	1990-91	12.22		
1941-42	14.66	1966-67	17.78	1991-92	16.07		
1942-43	17.91	1967-68	11.46	1992-93	26.55		
1943-44	17.89	1968-69	22.33	1993-94	9.26		
1944-45	11.25	1969-70	7.52	1994-95	26.82		
1945-46	10.31	1970-71	11.45	1995-96	10.68		
1946-47	15.24	1971-72	6.4	1996-97	13.95		
1947-48	8.62	1972-73	18.57	1997-98	32.47		
1948-49	9.04	1973-74	14.51	1998-99	7.29		
1949-50	10.14	1974-75	15.01	1999-00	9.21		
			Period of Record	**85 years**			
			Running 85 Year Average	**14.2 inches**			
			Minimum	**2.0 inches**			
			Maximum	**34.2 inches**			

* 2002/03 from station 388D (City of Paramount Fire Station), since 107D data are incomplete

Table 6

ANNUAL OVERDRAFT CALCULATION

for Current and Ensuing Water Years (in acre-feet)

Item	WATER YEAR 2010-2011	WATER YEAR 2011-2012
Average Annual Groundwater Deficiency (from Table 4)	(105,385)	(105,385)
Adjustments/Variances to AAGD		
(1) Local Water at Spreading Grounds[a]	10,000 [d]	0 [d]
(2) Precipitation, mountain front recharge, applied water[a]	5,000 [d]	0 [d]
(3) Subsurface inflow[b]	0 [d]	0 [d]
(4) Groundwater Extractions[c]	(9,600) [d]	(7,600) [d]
ANNUAL OVERDRAFT [AAGD+(1)+(2)+(3)-(4)]	(80,800)	(97,800)

Note: Numbers in parentheses represent negative values.

(a) Difference between actual and model average. Positive value indicates increased recharge.

(b) Difference between annual model value and average model value. Positive value indicates increased inflow. Does not include seawater intrusion inflow

(c) Difference between actual and model average. Positive value indicates increased pumpage.

(d) Estimated Values. A value of zero indicates average year was assumed.

Table 7

ACCUMULATED OVERDRAFT CALCULATION (in acre-feet)

ITEM	AMOUNT
Accumulated Overdraft at end of Previous Water Year	(726,300)
Estimated Annual Overdraft for Current Year	(80,800)
Subtotal without artificial replenishment	(807,100)
Planned Artificial Replenishment for Current Year	
Imported Water Purchased for Spreading*	24,500
Recycled Water Purchased for Spreading	50,000
Imported and Recycled Water Purchased for Barrier Wells	29,000
Replenishment Subtotal	103,500
PROJECTED ACCUMULATED OVERDRAFT FOR CURRENT YEAR	**(703,600)**

Note: Numbers in parentheses represent negative values.

* - 21,000 for normal annual amount + 3,500 af of planned but unpurchased water from previous years. Unpurchased due to unavailabilitiy of discounted replenishment water or other factors.

Table 8

CHANGES IN GROUNDWATER STORAGE

WATER YEAR	ANNUAL CHANGE IN STORAGE (AF)	CUMULATIVE CHANGE IN STORAGE (AF)	WATER YEAR	ANNUAL CHANGE IN STORAGE (AF)	CUMULATIVE CHANGE IN STORAGE (AF)	WATER YEAR	ANNUAL CHANGE IN STORAGE (AF)	CUMULATIVE CHANGE IN STORAGE (AF)
1961-62	88,500	88,500	1985-86	10,600	238,200	2009-10	27,000	141,500
1962-63	(11,100)	77,400	1986-87	4,000	242,200	2010-11	-	-
1963-64	10,300	87,700	1987-88	(11,700)	230,500	2011-12	-	-
1964-65	35,200	122,900	1988-89	10,400	240,900	2012-13	-	-
1965-66	21,100	144,000	1989-90	13,600	254,500	2013-14	-	-
1966-67	21,400	165,400	1990-91	28,400	282,900	2014-15	-	-
1967-68	11,400	176,800	1991-92	1,600	284,500	2015-16	-	-
1968-69	(7,500)	169,300	1992-93	45,800	330,300	2016-17	-	-
1969-70	(800)	168,500	1993-94	(28,500)	301,800	2017-18	-	-
1970-71	(3,400)	165,100	1994-95	19,400	321,200	2018-19	-	-
1971-72	(50,600)	114,500	1995-96	12,500	333,700	2019-20	-	-
1972-73	34,800	149,300	1996-97	15,700	349,400	2020-21	-	-
1973-74	(2,400)	146,900	1997-98	16,700	366,100	2021-22	-	-
1974-75	(14,100)	132,800	1998-99	(80,200)	285,900	2022-23	-	-
1975-76	(40,200)	92,600	1999-00	(30,000)	255,900	2023-24	-	-
1976-77	(32,900)	59,700	2000-01	(400)	255,500	2024-25	-	-
1977-78	88,600	148,300	2001-02	(36,500)	219,000	2025-26	-	-
1978-79	30,100	178,400	2002-03	(10,500)	208,500	2026-27	-	-
1979-80	(1,100)	177,300	2003-04	(43,000)	165,500	2027-28	-	-
1980-81	17,100	194,400	2004-05	89,100	254,600	2028-29	-	-
1981-82	18,400	212,800	2005-06	12,000	266,600	2029-30	-	-
1982-83	46,800	259,600	2006-07	(59,000)	207,600	2030-31	-	-
1983-84	(22,400)	237,200	2007-08	(41,600)	166,000	2031-32	-	-
1984-85	(9,600)	227,600	2008-09	(51,500)	114,500	2032-33	-	-

Note: Numbers in parentheses represent negative values.

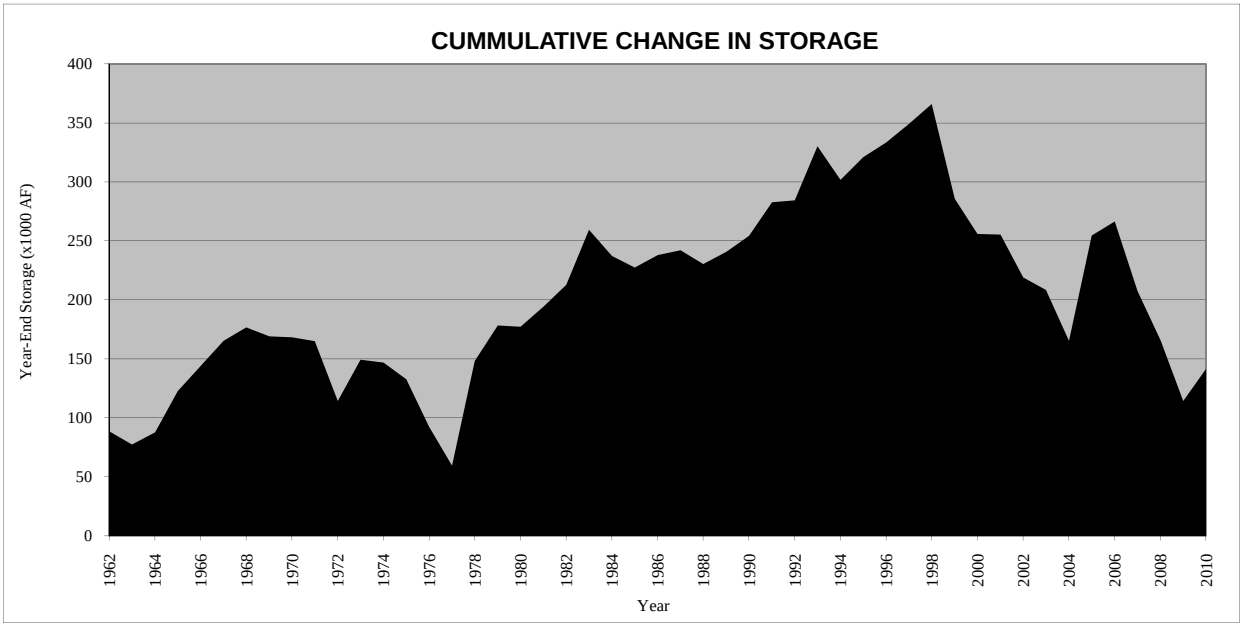


Table 9

QUANTITY OF WATER REQUIRED FOR ARTIFICIAL REPLENISHMENT

WATER TYPE	AMOUNT (AF)
Long Term Average for Imported Spreading (updated, see below)*	21,000
Recycled Water for Spreading (WRD Purchases)	50,000
Total Spreading	**71,000**
West Coast Barrier - Imported	10,000
West Coast Barrier - Recycled	8,000
Dominguez Gap - Imported	3,700
Dominguez Gap - Recycled	3,700
Alamitos Barrier - Imported - WRD portion only	3,100
Alamitos Barrier - Recycled - WRD portion only	3,100
Total Barriers	**31,600**
In-Lieu Central Basin	6,000
In-Lieu West Coast Basin	4,303
Total In-Lieu	**10,303**
Total Water Purchase Estimate for Ensuing Year	**112,903**

* - Derivation of new Long Term Imported Spreading Requirement is possible due to new projects that will capture more stormwater for conservation, and thus less imported needs:

1. Long Term Average of 27,600 af defined in 2003 ESR
2. Minus 3,000 afy for increasing Whittier Narrows Conservation Pool
3. Minus 3,600 afy for two new rubber dams on San Gabriel River
4. Equals new Long Term Average of **21,000** afy imported spreading

HISTORICAL AMOUNTS OF WATER REPLENISHED IN THE MONTEBELLO FOREBAY SPREADING GROUNDS

(In Acre-feet)

WATER YEAR	Imported Water		Recycled Water			Local Water [a]	Make-up Water		TOTAL
	LACFCD or Other	WRD	Whittier WRP	San Jose Creek WRP	Pomona WRP[g]	Stormwater & River Baseflow	USGVMWD & SGVMWD	CBMWD	
1953-54	30,000								30,000
1954-55	24,800								24,800
1955-56	54,500								54,500
1956-57	50,000								50,000
1957-58	105,100					87,558			192,658
1958-59	54,400					31,787			86,187
1959-60	80,900					20,064			100,964
1960-61	80,800	66,400				9,118			156,318
1961-62	39,500	168,600	1,178			39,548			248,826
1962-63	4,800	75,800	12,405			14,565			107,570
1963-64		104,900	13,258			9,992			128,150
1964-65	75,500	84,600	14,528			13,097			187,725
1965-66	67,800	53,900	15,056			45,754	6,500		189,010
1966-67	74,100	10,200	16,223			59,820	-		160,343
1967-68	66,600	28,800	18,275			39,760	-		153,435
1968-69	12,500	5,300	13,877			119,395	-		151,072
1969-70	25,800	43,100	17,158			52,917	-		138,975
1970-71	46,700	25,400	19,494			89,514	-		181,108
1971-72		34,450	17,543			17,688	-	-	69,681
1972-73		71,900	13,622	8,327		45,077	-	20,000	158,926
1973-74		68,200	13,385	7,064		29,171	-	23,900	141,720
1974-75		71,900	14,650	6,549		29,665	-	-	122,764
1975-76		50,800	12,394	9,062		22,073	-	-	94,329
1976-77		9,300	10,158	12,705		19,252	14,500	6,900	72,815
1977-78		39,900	13,104	5,997		147,317	-	-	206,318
1978-79		65,300	10,716	11,741		68,859	-	-	156,616
1979-80		10,200	14,568	9,815		106,820	10,900	-	152,303
1980-81	3,300	28,700	11,464	14,645		50,590	31,500	-	140,199
1981-82		4,600	14,133	15,285		47,930	30,900 [c]	-	112,848
1982-83		2,000	12,818	4,217		126,076	8,900 [c]	-	154,011
1983-84		1,500	13,194	14,590		60,710	20,800 [c]	-	110,794
1984-85		40,600	12,905	14,093		39,099	-	-	106,697
1985-86		21,500	13,827	11,487		66,966	-	-	113,780
1986-87		49,200	15,280	20,041		27,613	-	6,500	118,634
1987-88		23,300	14,585	27,182		50,068	5,800 [c]	-	120,935
1988-89		50,300	13,830	33,327		17,096	6,500 [c]	-	121,053
1989-90		52,700	15,043	33,498	1,568	9,388	13,600 [c]	-	125,797
1990-91		56,287	13,841	38,603	1,420	35,717	100 [c]	-	145,968
1991-92		43,103	12,620	31,326	2,957	136,357	-	-	226,363
1992-93		16,561	11,026	29,811	8,027	147,699	-	-	213,124
1993-94		20,411	10,249	40,768	2,965	55,896	-	-	130,288
1994-95		21,837	10,642	18,431	4,228	100,578	-	-	155,715
1995-96		17,961	9,971	40,922	2,969	62,920	-	-	134,743
1996-97		19,990	9,850	36,977	3,132	58,262	-	-	128,211
1997-98		953	8,378	26,483	2,156	96,706	-	-	134,676
1998-99		-	10,968	34,782	1,451	32,013	-	-	79,214
1999-00		45,037	8,950	30,481	3,839	20,607	-	-	108,914
2000-01		23,451	8,253	35,165	2,925	39,725	-	-	109,519
2001-02		42,875 [d]	8,474	50,194	1,928	17,000	-	-	120,471
2002-03		22,365 [e]	5,156	35,320	2,320	58,202	-	-	123,363
2003-04		27,520 [f]	8,195	34,033	2,697	30,467	-	-	102,912
2004-05		25,145 [f]	6,741	20,547	2,215	148,674	-	-	203,322
2005-06		33,229	8,868	30,180	2,973	60,377	-	-	135,628
2006-07		40,214	7,334	34,823	2,882	11,495	-	-	96,748
2007-08	1,510	- [b]	6,212	29,131	4,424	54,518	-	-	95,795
2008-09		-	5,202	29,999	4,410	35,348	-	-	74,959
2009-10		26,286	5,431	45,538	4,762	35,398	-	-	117,415
TOTAL	898,610	1,846,574	575,032	933,139	66,246		150,000	57,300	**7,379,207**
	Import:	2,745,184		Recycled:	1,574,417	Local: 2,852,306	Make-up:	207,300	

(a) Local water is stormwater or river baseflow captured at the Montebello Forebay Spreading Grounds.
(b) CBMWD purchased 1,510 af of imported water for spreading for Downey, Lakewood, and Cerritos.
(c) Includes State Project water imported by the San Gabriel Valley Municipal Water District.
(d) Includes 1,607 af of EPA extracted groundwater from Whittier Narrows considered imported water to WRD. Paid for in 2003.
(e) Includes 5,069 af of EPA extracted groundwater from W.N. considered imported water to WRD. Paid for in June 2005.
(f) includes 13,000 af of water banked by Long Beach under a storage agreement with WRD (792 af 02/03, 12,210 af 3/04).
(g)Pomona WRP data reliable starting 1989/90. May have been discharges to spreading grounds prior to this, but not verifiable.

HISTORICAL AMOUNTS OF WATER PURCHASED FOR INJECTION

(In Acre-feet)

Water Year	West Coast Barrier (a)			Dominguez Gap Barrier (b)			Alamitos Barrier							TOTAL
							WRD			OCWD			Total	
	Imported	Recycled	Total	Imported	Recycled	Total	Imported	Recycled	Total	Imported	Recycled	Total		
1952-53	1,140		1,140											1,140
1953-54	3,290		3,290											3,290
1954-55	2,740		2,740											2,740
1955-56	2,840		2,840											2,840
1956-57	3,590		3,590											3,590
1957-58	4,330		4,330											4,330
1958-59	3,700		3,700											3,700
1959-60	3,800		3,800											3,800
1960-61	4,480		4,480											4,480
1961-62	4,510		4,510											4,510
1962-63	4,200		4,200											4,200
1963-64	10,450		10,450											10,450
1964-65	33,020		33,020				2,760		2,760	200		200	2,960	35,980
1965-66	44,390		44,390				3,370		3,370	350		350	3,720	48,110
1966-67	43,060		43,060				3,390		3,390	490		490	3,880	46,940
1967-68	39,580		39,580				4,210		4,210	740		740	4,950	44,530
1968-69	36,420		36,420				4,310		4,310	950		950	5,260	41,680
1969-70	29,460		29,460				3,760		3,760	720		720	4,480	33,940
1970-71	29,870		29,870	2,200		2,200	3,310		3,310	822		822	4,132	36,202
1971-72	26,490		26,490	9,550		9,550	4,060		4,060	936		936	4,996	41,036
1972-73	28,150		28,150	8,470		8,470	4,300		4,300	883		883	5,183	41,803
1973-74	27,540		27,540	7,830		7,830	6,140		6,140	1,148		1,148	7,288	42,658
1974-75	26,430		26,430	5,160		5,160	4,440		4,440	658		658	5,098	36,688
1975-76	35,220		35,220	4,940		4,940	4,090		4,090	565		565	4,655	44,815
1976-77	34,260		34,260	9,280		9,280	4,890		4,890	885		885	5,775	49,315
1977-78	29,640		29,640	5,740		5,740	4,020		4,020	833		833	4,853	40,233
1978-79	23,720		23,720	5,660		5,660	4,220		4,220	898		898	5,118	34,498
1979-80	28,630		28,630	4,470		4,470	3,560		3,560	459		459	4,019	37,119
1980-81	26,350		26,350	3,550		3,550	3,940		3,940	524		524	4,464	34,364
1981-82	24,640		24,640	4,720		4,720	4,540		4,540	392		392	4,932	34,292
1982-83	33,950		33,950	6,020		6,020	3,270		3,270	1,946		1,946	5,216	45,186
1983-84	28,000		28,000	7,640		7,640	2,440		2,440	1,402		1,402	3,842	39,482
1984-85	25,210		25,210	7,470		7,470	3,400		3,400	1,444		1,444	4,844	37,524
1985-86	20,260		20,260	6,160		6,160	3,410		3,410	1,863		1,863	5,273	31,693
1986-87	26,030		26,030	6,230		6,230	4,170		4,170	2,887		2,887	7,057	39,317
1987-88	24,270		24,270	7,050		7,050	3,990		3,990	2,173		2,173	6,163	37,483
1988-89	22,740		22,740	5,220		5,220	3,900		3,900	1,674		1,674	5,574	33,534
1989-90	20,279		20,279	5,736		5,736	4,110		4,110	1,929		1,929	6,039	32,054
1990-91	16,039		16,039	7,756		7,756	4,096		4,096	1,818		1,818	5,914	29,709
1991-92	22,180		22,180	6,894		6,894	4,172		4,172	1,552		1,552	5,724	34,798
1992-93	21,516		21,516	4,910		4,910	3,350		3,350	1,565		1,565	4,915	31,341
1993-94	15,482		15,482	5,524		5,524	2,794		2,794	1,309		1,309	4,103	25,109
1994-95	14,237	1,480	15,717	4,989		4,989	2,883		2,883	890		890	3,773	24,479
1995-96	12,426	4,170	16,596	5,107		5,107	3,760		3,760	2,010		2,010	5,770	27,473
1996-97	11,388	6,241	17,629	5,886		5,886	4,015		4,015	1,750		1,750	5,765	29,280
1997-98	8,173	8,308	16,481	3,771		3,771	3,677		3,677	1,504		1,504	5,181	25,433
1998-99	10,125	6,973	17,097	4,483		4,483	4,012		4,012	1,689		1,689	5,700	27,280
1999-00	11,172	7,460	18,632	6,010		6,010	4,028		4,028	1,707		1,707	5,735	30,377
2000-01	13,988	6,838	20,826	3,923		3,923	3,710		3,710	1,964		1,964	5,674	30,423
2001-02	12,724	7,276	20,000	5,459		5,459	3,961		3,961	2,232		2,232	6,193	31,652
2002-03	10,419	6,192	16,611	8,056		8,056	3,445		3,445	1,197		1,197	4,642	29,309
2003-04	9,304	3,669	12,973	6,089		6,089	3,876		3,876	2,092		2,092	5,968	25,030
2004-05	4,548	3,920	8,468	8,557		8,557	2,870		2,870	1,685		1,685	4,555	21,580
2005-06	5,997	4,249	10,246	7,259	1,450	8,709	1,042	921	1,963	330	254	584	2,547	21,502
2006-07	4,373	10,960	15,333	5,510	1,733	7,243	1,568	219	1,787	543	165	708	2,495	25,071
2007-08	3,662	10,954	14,616	4,468	2,452	6,920	3,467	1,284	4,751	1,283	475	1,758	6,509	28,045
2008-09	7,178	6,434	13,612	4,550	2,414	6,964	4,145	1,275	5,420	1,518	535	2,053	7,473	28,049
2009-10	9,661	7,620	17,281	5,495	2,037	7,532	2,596	1,775	4,371	659	470	1,129	5,500	30,313
TOTAL	1,041,271	102,743	1,144,014	237,792	10,086	247,878	169,467	5,474	174,941	57,069	1,899	58,967	233,908	1,625,799

(a) Prior to 10/1/71, water was purchased by the State, West Basin Water Association, local water interests, Zone II of the LA County Flood Control District and WRD. After 10/1/71, all purchases have been by WRD

(b) In 1970-71, purchases were shared by WRD and Zone II. After 10/1/71, all purchases have been by WRD

17,752 11,432 29,184 29,184

HISTORICAL AMOUNTS OF THE IN-LIEU PROGRAM

(In Acre-Feet)

WATER YEAR	CENTRAL BASIN	WEST COAST BASIN	TOTAL
1965-66	-	745	745
1966-67	-	851	851
1967-68	-	850	850
1968-69	-	850	850
1969-70	-	900	900
1970-71	-	881	881
1971-72	-	756	756
1972-73	-	901	901
1973-74	-	901	901
1974-75	-	400	400
1975-76	-	400	400
1976-77	-	400	400
1977-78	11,316	4,815	16,131
1978-79	9,723	8,655	18,378
1979-80	10,628	4,333	14,961
FISCAL YEAR			
1980-81	17,617	6,206	23,823
1981-82	14,050	4,833	18,883
1982-83	13,813	5,939	19,752
1983-84	29,216	12,524	41,740
1984-85	23,246	13,594	36,840
1985-86	15,505	10,627	26,132
1986-87	16,205	12,997	29,202
1987-88	15,518	12,893	28,411
1988-89	11,356	14,069	25,425
1989-90	16,858	12,293	29,151
1990-91	11,886	10,153	22,039
1991-92	13,000	6,104	19,104
1992-93	37,652	15,654	53,306
1993-94	83,488	26,093	109,581
1994-95	32,904	17,994	50,898
1995-96	37,517	13,816	51,333
1996-97	34,547	4,847	39,394
1997-98	22,995	7,335	30,330
1998-99	13,213	10,303	23,516
1999-00	18,799	3,479	22,278
2000-01	18,364	2,817	21,181
2001-02	11,931	8,789	20,720
2002-03	6,866	4,339	11,205
2003-04	-	-	-
2004-05	6,000	1,804	7,804
2005-06	7,475	2,414	9,889
2006-07	5,779	3,480	9,259
2007-08	-	-	-
2008-09	-	-	-
2009-10	-	-	-
TOTAL	567,468	272,035	839,503

HISTORICAL AMOUNTS OF
WATER FOR REPLENISHMENT

(In Acre-feet)

WATER YEAR	SPREADING					INJECTION*			IN-LIEU	TOTAL
	IMPORTED WATER	RECLAIMED WATER	LOCAL WATER	MAKEUP WATER	TOTAL	Imported	Recycled	Total		
1952-53						1,140	-	1,140		1,140
1953-54	30,000			-	30,000	3,290	-	3,290		33,290
1954-55	24,800			-	24,800	2,740	-	2,740		27,540
1955-56	54,500			-	54,500	2,840	-	2,840		57,340
1956-57	50,000			-	50,000	3,590	-	3,590		53,590
1957-58	105,100		87,558	-	192,658	4,330	-	4,330		196,988
1958-59	54,400		31,787	-	86,187	3,700	-	3,700		89,887
1959-60	80,900		20,064	-	100,964	3,800	-	3,800		104,764
1960-61	147,200		9,118	-	156,318	4,480	-	4,480		160,798
1961-62	208,100	1,178	39,548	-	248,826	4,510	-	4,510		253,336
1962-63	80,600	12,405	14,565	-	107,570	4,200	-	4,200		111,770
1963-64	104,900	13,258	9,992	-	128,150	10,450	-	10,450		138,600
1964-65	160,100	14,528	13,097	-	187,725	35,980	-	35,980		223,705
1965-66	121,700	15,056	45,754	6,500	189,010	48,110	-	48,110	745	237,865
1966-67	84,300	16,223	59,820	-	160,343	46,940	-	46,940	851	208,134
1967-68	95,400	18,275	39,760	-	153,435	44,530	-	44,530	850	198,815
1968-69	17,800	13,877	119,395	-	151,072	41,680	-	41,680	850	193,602
1969-70	68,900	17,158	52,917	-	138,975	33,940	-	33,940	900	173,815
1970-71	72,100	19,494	89,514	-	181,108	36,202	-	36,202	881	218,191
1971-72	34,450	17,543	17,688	-	69,681	41,036	-	41,036	756	111,473
1972-73	71,900	21,949	45,077	20,000	158,926	41,803	-	41,803	901	201,630
1973-74	68,200	20,449	29,171	23,900	141,720	42,658	-	42,658	901	185,279
1974-75	71,900	21,199	29,665	-	122,764	36,688	-	36,688	400	159,852
1975-76	50,800	21,456	22,073	-	94,329	44,815	-	44,815	400	139,544
1976-77	9,300	22,863	19,252	21,400	72,815	49,315	-	49,315	400	122,530
1977-78	39,900	19,101	147,317	-	206,318	40,233	-	40,233	16,131	262,682
1978-79	65,300	22,457	68,859	-	156,616	34,498	-	34,498	18,378	209,492
1979-80	10,200	24,383	106,820	10,900	152,303	37,119	-	37,119	14,961	204,383
1980-81	32,000	26,109	50,590	31,500	140,199	34,364	-	34,364	23,823	198,386
1981-82	4,600	29,418	47,930	30,900	112,848	34,292	-	34,292	18,883	166,023
1982-83	2,000	17,035	126,076	8,900	154,011	45,186	-	45,186	19,752	218,949
1983-84	1,500	27,784	60,710	20,800	110,794	39,482	-	39,482	41,740	192,016
1984-85	40,600	26,998	39,099	-	106,697	37,524	-	37,524	36,840	181,061
1985-86	21,500	25,314	66,966	-	113,780	31,693	-	31,693	26,132	171,605
1986-87	49,200	35,321	27,613	6,500	118,634	39,317	-	39,317	29,202	187,153
1987-88	23,300	41,767	50,068	5,800	120,935	37,483	-	37,483	28,411	186,829
1988-89	50,300	47,157	17,096	6,500	121,053	33,534	-	33,534	25,425	180,012
1989-90	52,700	50,109	9,388	13,600	125,797	32,054	-	32,054	29,151	187,002
1990-91	56,287	53,864	35,717	100	145,968	29,709	-	29,709	22,039	197,716
1991-92	43,103	46,903	136,357	-	226,363	34,798	-	34,798	19,104	280,265
1992-93	16,561	48,864	147,699	-	213,124	31,341	-	31,341	53,306	297,771
1993-94	20,411	53,981	55,896	-	130,288	25,109	-	25,109	109,581	264,978
1994-95	21,837	33,300	100,578	-	155,715	22,999	1,480	24,479	50,898	231,092
1995-96	17,961	53,862	62,920	-	134,743	23,304	4,170	27,473	51,333	213,549
1996-97	19,990	49,959	58,262	-	128,211	23,039	6,241	29,280	39,394	196,885
1997-98	953	37,017	96,706	-	134,676	17,125	8,308	25,433	30,330	190,439
1998-99	-	47,201	32,013	-	79,214	20,308	6,973	27,280	23,516	130,010
1999-00	45,037	43,270	20,607	-	108,914	22,917	7,460	30,377	22,278	161,569
2000-01	23,451	46,343	39,725	-	109,519	23,585	6,838	30,423	21,181	161,123
2001-02	42,875	60,596	17,000	-	120,471	24,376	7,276	31,652	20,720	172,843
2002-03	22,365	42,796	58,202	-	123,363	23,117	6,192	29,309	11,205	163,877
2003-04	27,520	44,925	30,467	-	102,912	21,361	3,669	25,030	-	127,942
2004-05	25,145	29,503	148,674	-	203,322	17,660	3,920	21,580	7,804	232,706
2005-06	33,229	42,022	60,377	-	135,628	14,628	6,874	21,502	9,889	167,019
2006-07	40,214	45,039	11,495	-	96,748	11,994	13,077	25,071	9,259	131,078
2007-08	1,510	39,767	54,518	-	95,795	12,880	15,165	28,045	-	123,840
2008-09	-	39,611	35,348	-	74,959	17,391	10,658	28,049	-	103,008
2009-10	26,286	55,731	35,398	-	117,415	18,411	11,902	30,313	-	147,728
TOTAL	2,745,184	1,574,417	2,852,306	207,300	7,379,207	1,505,597	120,202	1,625,799	839,503	9,844,510

** - Including Orange County sidc of Alamitos Barrier*

HISTORICAL AMOUNTS OF GROUNDWATER PRODUCTION

(In Acre-feet)

YEAR	CENTRAL BASIN	WEST COAST BASIN	TOTAL
WATER YEAR			
1960-61	292,500	61,900	354,400
1961-62	275,800	59,100	334,900
1962-63	225,400	59,100	284,500
1963-64	219,100	61,300	280,400
1964-65	211,600	59,800	271,400
1965-66	222,800	60,800	283,600
1966-67	206,700	62,300	269,000
1967-68	220,100	61,600	281,700
1968-69	213,800	61,600	275,400
1969-70	222,200	62,600	284,800
1970-71	211,600	60,900	272,500
1971-72	216,100	64,800	280,900
1972-73	205,600	60,300	265,900
1973-74	211,300	55,000	266,300
1974-75	213,100	56,700	269,800
1975-76	215,300	59,400	274,700
1976-77	211,500	59,800	271,300
1977-78	196,600	58,300	254,900
1978-79	207,000	58,000	265,000
1979-80	209,500	57,100	266,600
1980-81	211,915	57,711	269,626
1981-82	202,587	61,874	264,461
1982-83	194,548	57,542	252,090
1983-84	196,660	51,930	248,590
1984-85	193,085	52,746	245,831
1985-86	195,972	53,362	249,334
1986-87	196,660	48,026	244,686
1987-88	194,704	43,837	238,541
1988-89	200,207	44,323	244,530
1989-90	197,621	48,047	245,668
1990-91	187,040	53,660	240,700
1991-92	196,400	56,318	252,718
1992-93	150,495	40,241	190,736
1993-94	156,565	41,826	198,391
1994-95	180,269	41,729	221,998
1995-96	182,414	52,222	234,636
1996-97	187,561	52,576	240,137
1997-98	188,305	51,859	240,164
1998-99	204,418	51,926	256,344
1999-00	198,483	53,599	252,082
2000-01	195,361	53,870	249,231
2001-02	200,168	50,063	250,231
2002-03	190,268	51,946	242,214
2003-04	200,365	48,013	248,378
2004-05	188,707	41,297	230,004
2005-06	191,030	36,809	227,839
2006-07	198,115	37,655	235,770
2007-08	206,260	38,472	244,732
2008-09	198,156	45,246	243,402
2009-10	197,387	43,942	241,329
TOTAL	10,189,326	2,663,067	12,852,393

HISTORICAL AMOUNTS OF TOTAL WATER USE IN THE WATER REPLENISHMENT DISTRICT*

(In Acre-feet)

YEAR	GROUNDWATER PRODUCTION	IMPORTED WATER FOR DIRECT USE*	RECLAIMED WATER FOR DIRECT USE*	TOTAL
WATER YEAR				
1960-61	354,400	196,800		551,200
1961-62	334,900	178,784		513,684
1962-63	284,500	222,131		506,631
1963-64	280,400	257,725		538,125
1964-65	271,400	313,766		585,166
1965-66	283,600	308,043		591,643
1966-67	269,000	352,787		621,787
1967-68	281,700	374,526		656,226
1968-69	275,400	365,528		640,928
1969-70	284,800	398,149		682,949
1970-71	272,500	397,122		669,622
1971-72	280,900	428,713		709,613
1972-73	265,900	400,785		666,685
1973-74	266,300	410,546		676,846
1974-75	269,800	380,228		650,028
1975-76	274,700	404,958		679,658
1976-77	271,300	355,896		627,196
1977-78	254,900	373,116		628,016
1978-79	265,000	380,101	100 [(a)]	645,201
1979-80	266,600	397,213	200	664,013
1980-81	269,626	294,730	300	564,656
1981-82	264,461	391,734	300	656,495
1982-83	252,090	408,543	400	661,033
1983-84	248,590	441,151	1,800	691,541
1984-85	245,831	451,549	2,000	699,380
1985-86	249,334	427,860	2,400	679,594
1986-87	244,686	478,744	2,300	725,730
1987-88	238,541	479,318	3,500	721,359
1988-89	244,530	466,166	5,300	715,996
1989-90	245,668	448,285	5,900	699,853
1990-91	240,700	485,109	5,000	730,809
1991-92	252,718	395,191	4,900	652,809
1992-93	190,736	388,949	824	580,509
1993-94	198,391	483,287	3,413	685,091
1994-95	221,998	437,191	6,143	665,332
1995-96	234,636	426,699	19,804	681,139
1996-97	240,137	436,569	25,046	701,752
1997-98	240,164	375,738	27,075	642,977
1998-99	256,344	396,655	30,510	683,509
1999-00	252,082	395,681	33,589	681,352
2000-01	249,231	395,024	32,589	676,844
2001-02	250,231	395,799	38,694	684,724
2002-03	242,214	381,148	38,839	662,201
2003-04	248,378	389,233	36,626	674,237
2004-05	230,004	402,660	33,988	666,652
2005-06	227,839	366,815	35,301	629,955
2006-07	235,770	376,492	41,899	654,161
2007-08	244,732	346,035	45,120	635,887
2008-09	243,402	320,711	43,153	607,266
2009-10	241,329	278,857	43,547	563,734
TOTAL	12,852,393	19,058,840	570,561	32,481,793

(a) Los Coyotes on-line in 1979; Long Beach on-line in 1980

** - Includes imported & recycled at seawater barriers, but not spreading grounds.*

WRD GROUNDWATER BANKING PROGRAM

(In Acre-feet)

WATER YEAR	CITY OF LONG BEACH			LONG BEACH/ALAMITOS BARRIER Seasonal Water			LONG BEACH/ALAMITOS BARRIER Tier 1 Water			TOTAL		
	Banked	Called	Balance	Banked	Called	Balance	Banked	Called	Balance	Banked	Called	Balance
2002-03	4,864	-	4,864	-	-	-	-	-	-	4,864	-	4,864
2003-04	8,136	-	13,000	-	-	-	-	-	-	8,136	-	13,000
2004-05	-	-	13,000	3,652	-	3,652	-	-	-	3,652	-	16,652
2005-06	-	-	13,000	1,324	56	4,919	-	-	-	1,324	56	17,919
2006-07	-	-	13,000	300	1,561	3,658	-	-	-	300	1,561	16,658
2007-08	-	2,416	10,584	-	1,498	2,160	-	-	-	-	3,914	12,744
2008-09	-	4,182	6,402	-	-	2,160	2,000	-	2,000	2,000	4,182	10,562
2009-10	-	-	6,402	-	-	2,160	-	2,000	-	-	2,000	8,562
TOTAL	13,000	6,598		5,275	3,115		2,000	2,000		20,275	11,713	

* Numbers were updated from last year's ESR following MWD accounting

FIGURES

HISTORICAL RAINFALL
DPW Station #107D - WRD Tracking Station

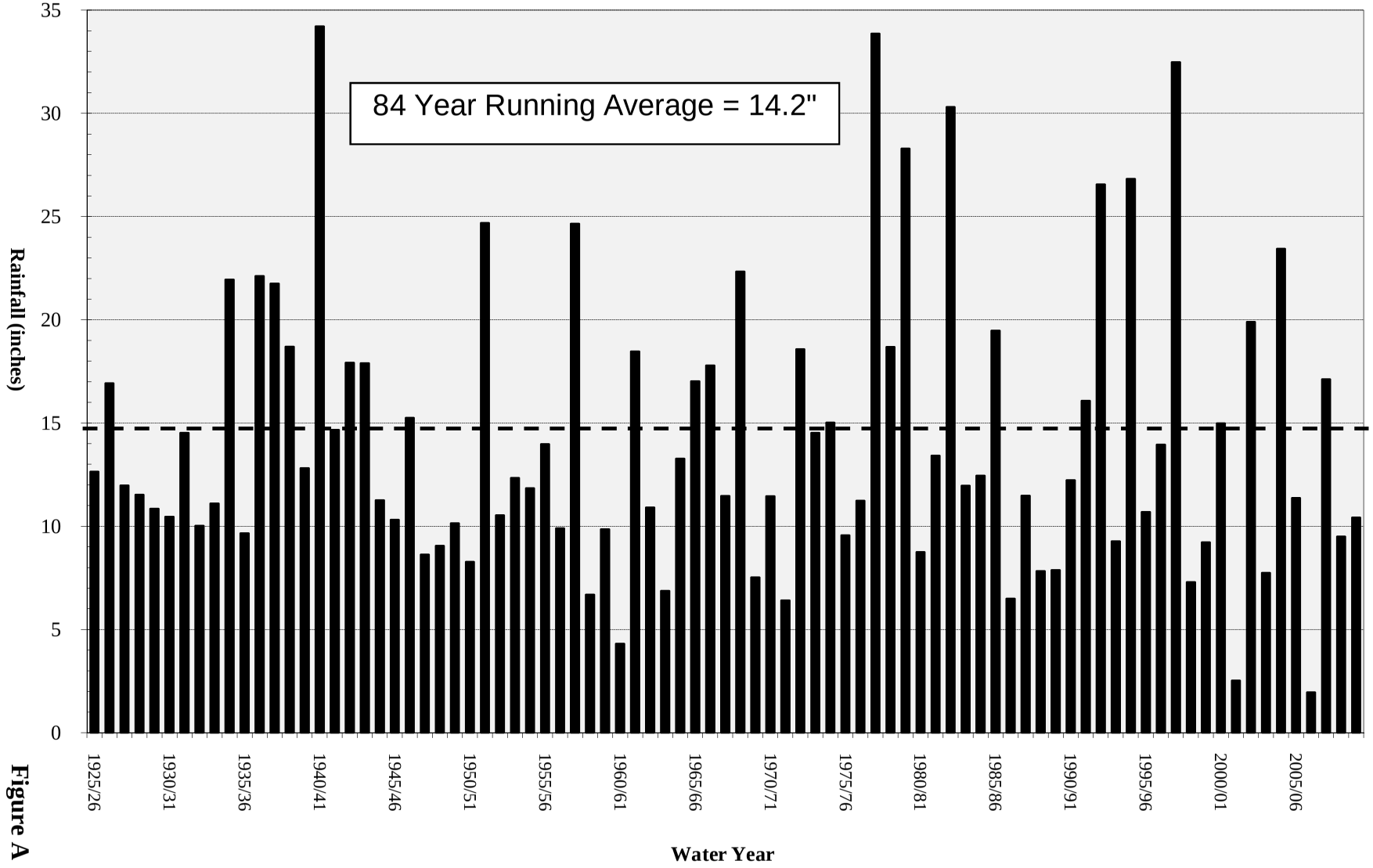
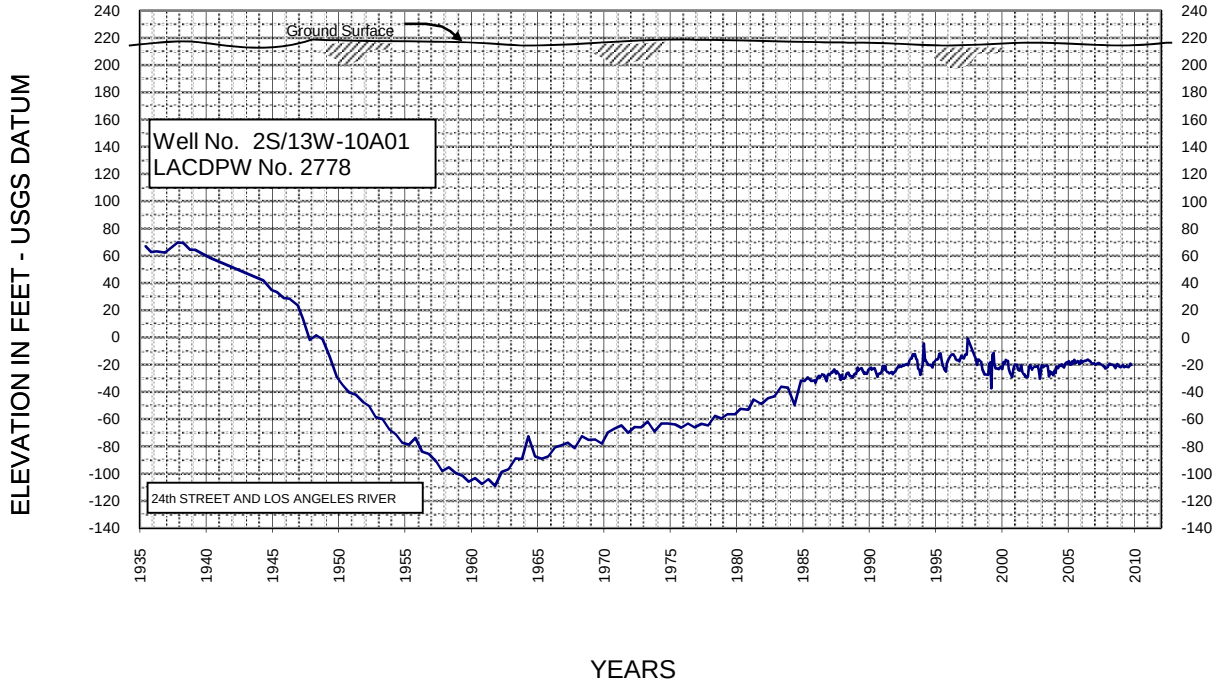


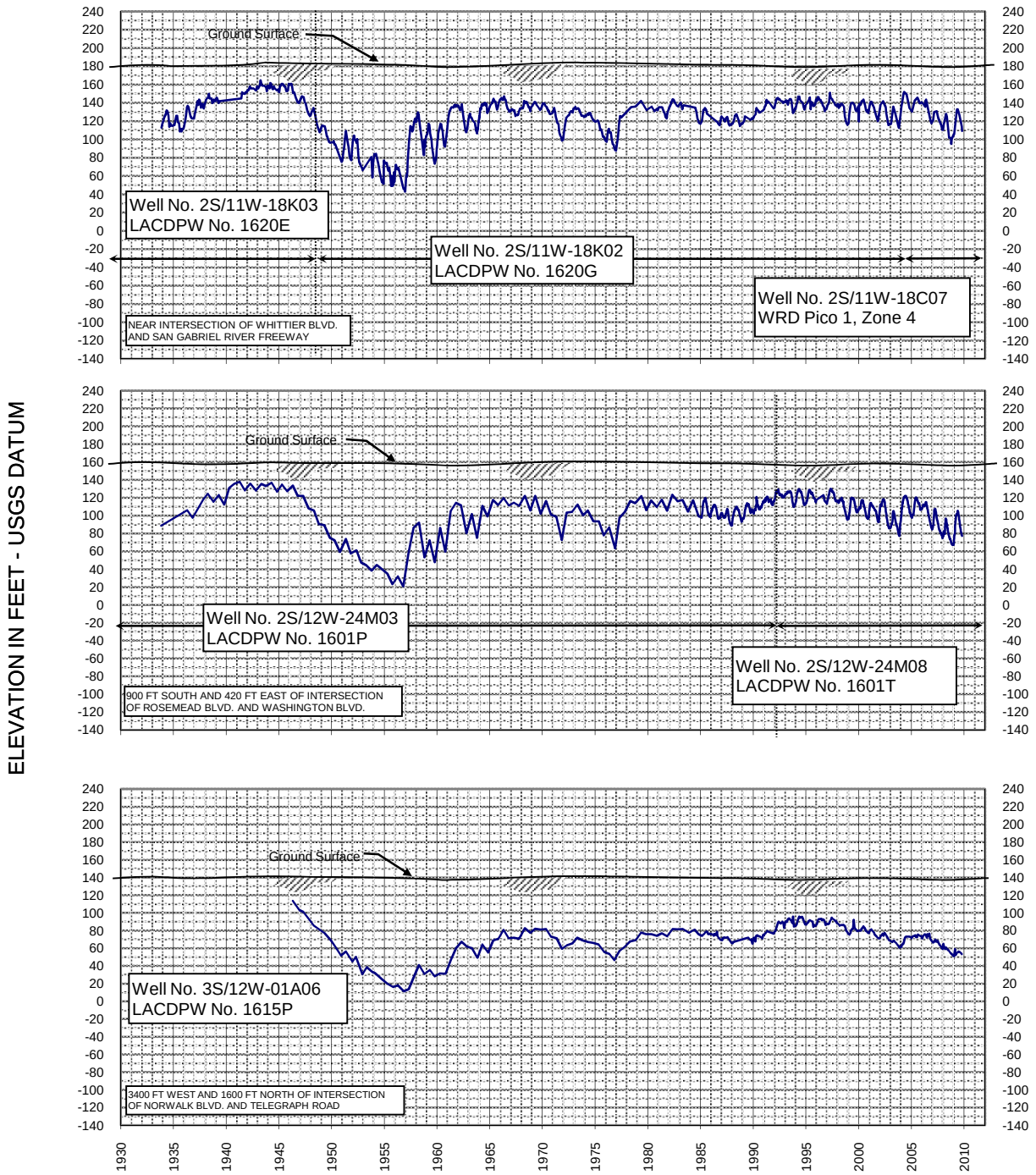
Figure A



FLUCTUATIONS OF WATER LEVEL AT WELLS

LOS ANGELES FOREBAY

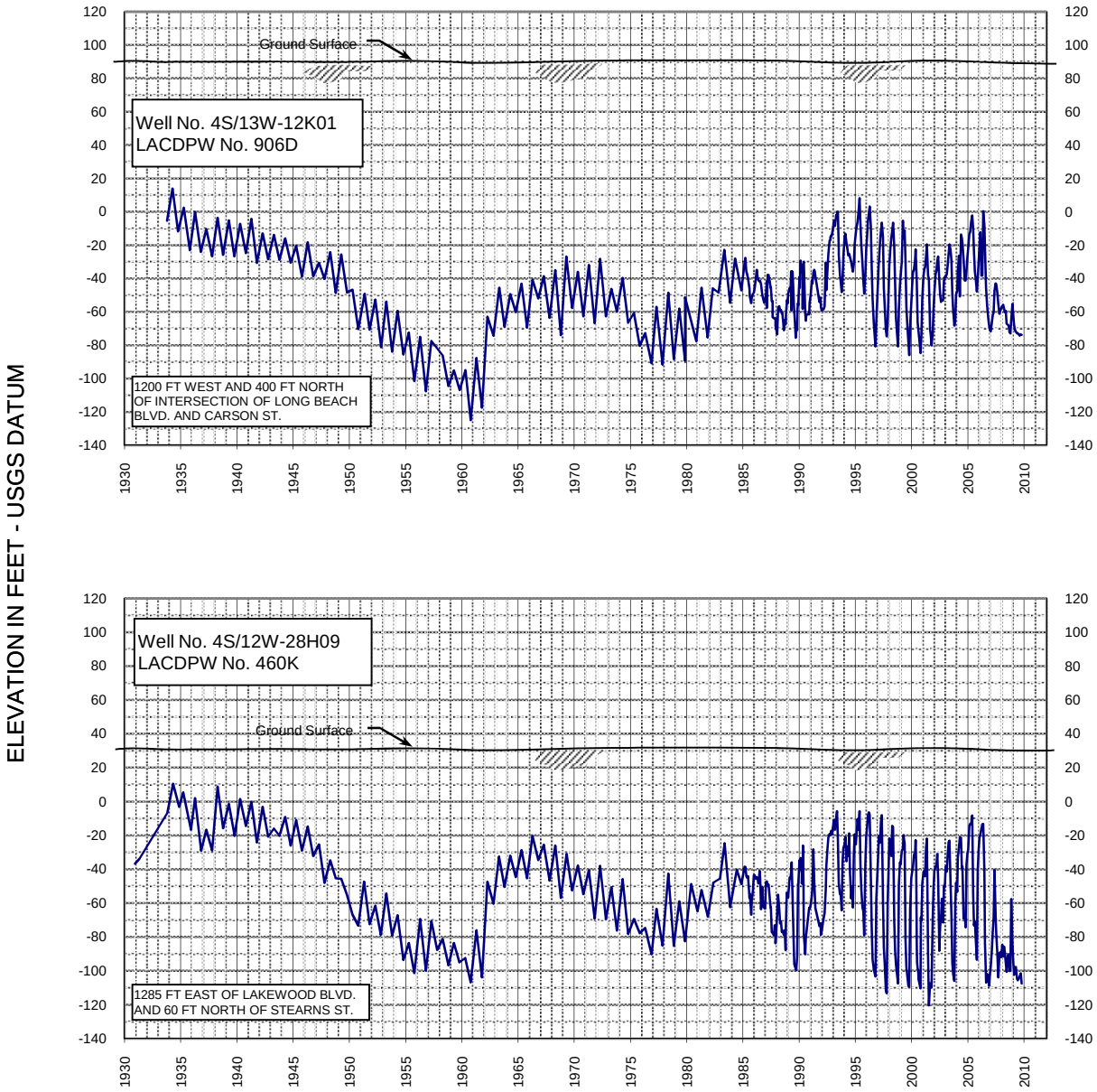
Figure B



FLUCTUATIONS OF WATER LEVEL AT WELLS

MONTEBELLO FOREBAY

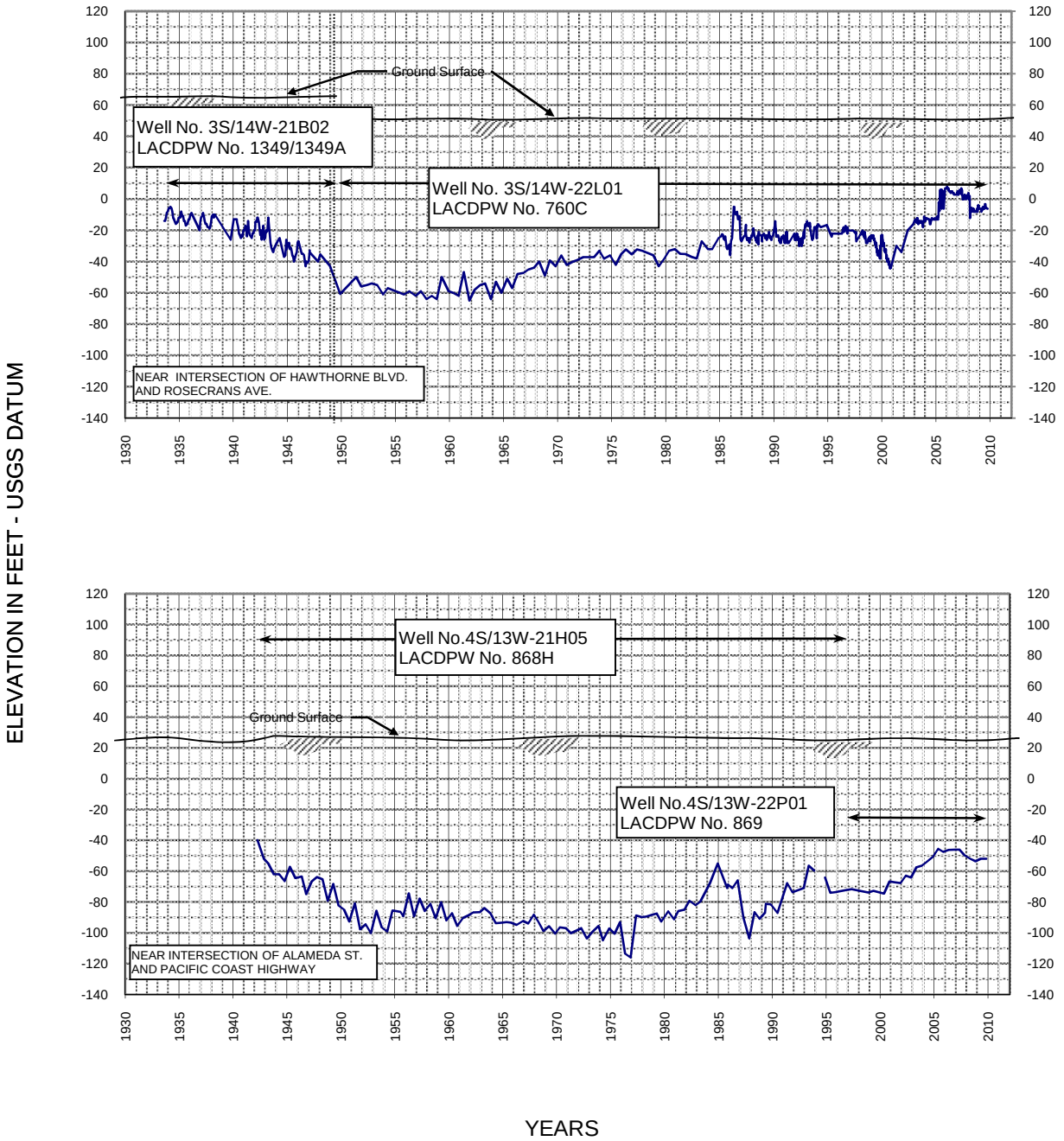
Figure C



FLUCTUATIONS OF WATER LEVEL AT WELLS

CENTRAL BASIN PRESSURE AREA

Figure D



FLUCTUATIONS OF WATER LEVEL AT WELLS

WEST BASIN

Figure E

PLATES

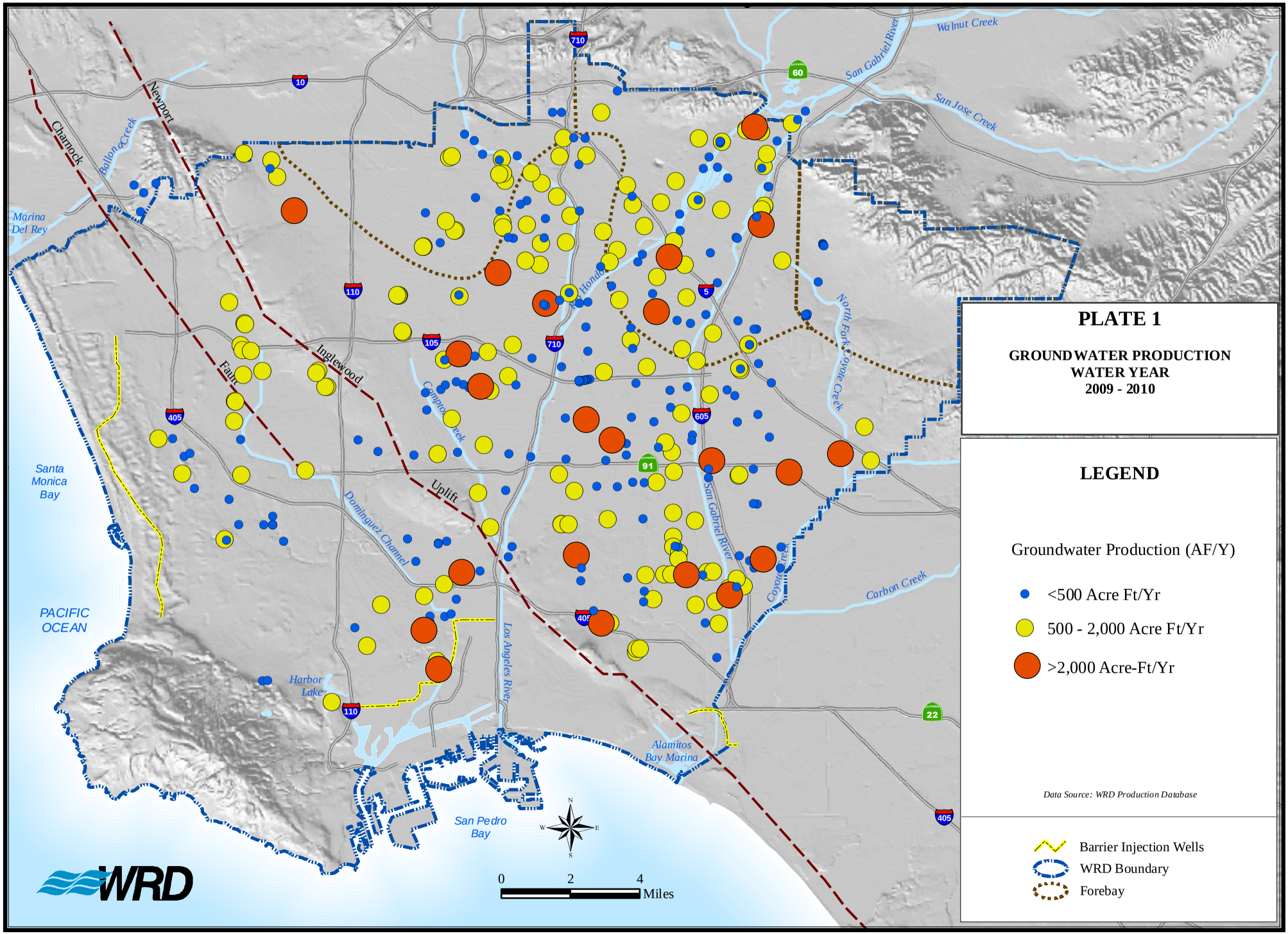


PLATE 1
GROUNDWATER PRODUCTION
WATER YEAR
2009 - 2010
LEGEND
Groundwater Production (AF/Y)
<500 Acre Ft/Yr
500 - 2,000 Acre Ft/Yr
>2,000 Acre-Ft/Yr
Data Source: WRD Production Database
Barrier Injection Wells
WRD Boundary
Forebay
WRD
0 2 4
Miles
PACIFIC OCEAN
Santa Monica Bay
Marina Del Rey
Ballona Creek
Newport
Chamock
Inglewood
Fault
Uplift
Dominguez Channel
Compton Creek
Los Angeles River
San Gabriel River
Coyote Creek
North Fork Coyote Creek
Carbon Creek
San Jose Creek
Walnut Creek
Harbor Lake
Alamitos Bay Marina
San Pedro Bay
710
10
110
105
405
91
605
60
5
22

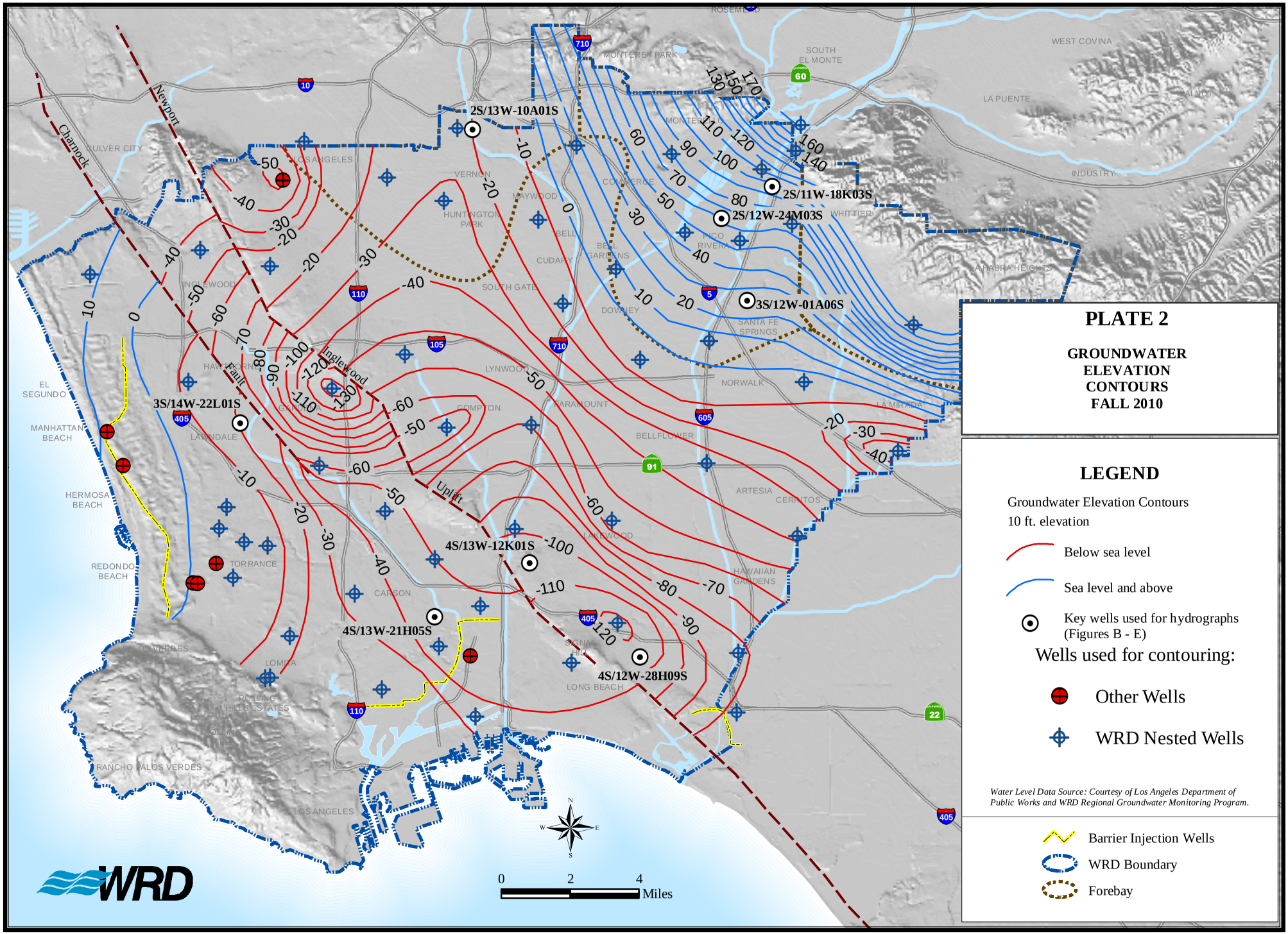


PLATE 2
GROUNDWATER ELEVATION CONTOURS FALL 2010
LEGEND
Groundwater Elevation Contours
10 ft. elevation
Below sea level
Sea level and above
Key wells used for hydrographs (Figures B - E)
Wells used for contouring:
Other Wells
WRD Nested Wells
Water Level Data Source: Courtesy of Los Angeles Department of Public Works and WRD Regional Groundwater Monitoring Program.
Barrier Injection Wells
WRD Boundary
Forebay
2S/13W-10A01S
2S/11W-18K03S
2S/12W-24M03S
3S/12W-01A06S
3S/14W-22L01S
4S/13W-12K01S
4S/13W-21H05S
4S/12W-28H09S
Newport
Charnock
Inglewood
Fault
Uplift
WRD
0 2 4 Miles

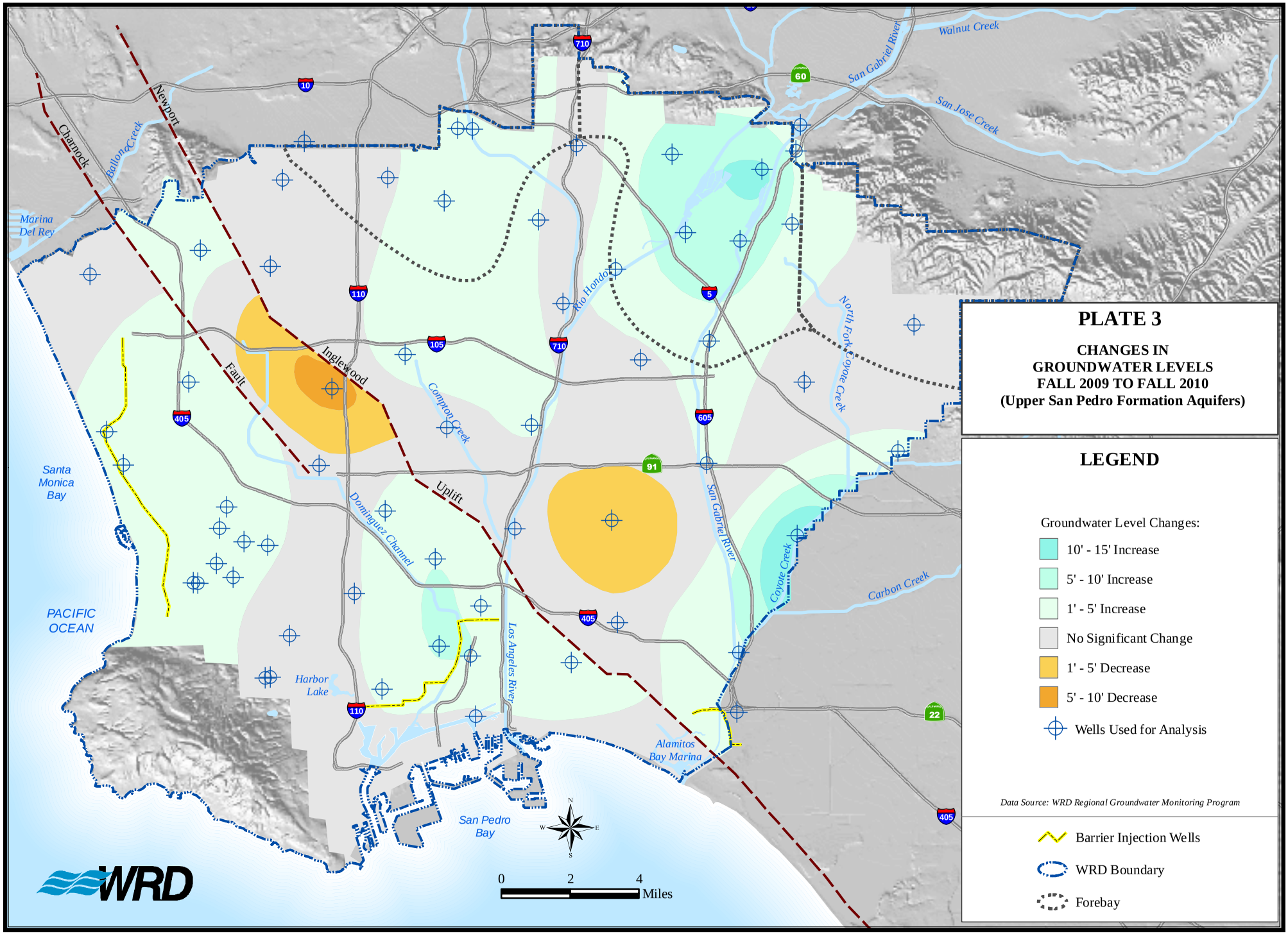


PLATE 3
CHANGES IN
GROUNDWATER LEVELS
FALL 2009 TO FALL 2010
(Upper San Pedro Formation Aquifers)
LEGEND
Groundwater Level Changes:
10' - 15' Increase
5' - 10' Increase
1' - 5' Increase
No Significant Change
1' - 5' Decrease
5' - 10' Decrease
Wells Used for Analysis
Data Source: WRD Regional Groundwater Monitoring Program
Barrier Injection Wells
WRD Boundary
Forebay
Walnut Creek
San Gabriel River
San Jose Creek
Newport
Chanock
Ballona Creek
Marina
Del Rey
Rio Hondo
North Fork Coyote Creek
Inglewood
Fault
Compton Creek
Uplift
Santa
Monica
Bay
Dominguez Channel
San Gabriel River
Coyote Creek
Carbon Creek
PACIFIC
OCEAN
Harbor
Lake
Los Angeles River
Alamitos
Bay Marina
San Pedro
Bay
N
W
E
S
0
2
4
Miles
WRD